



This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

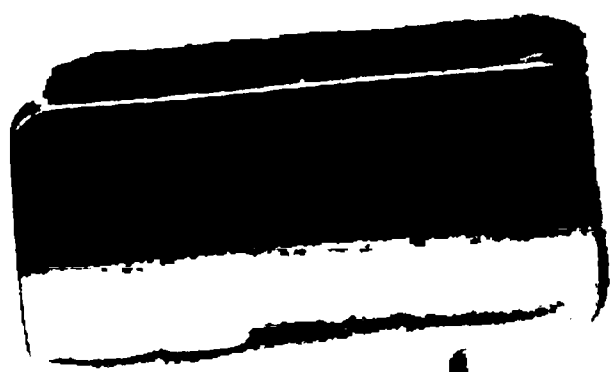
Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

- + *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.
- + *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.
- + *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.
- + *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at <http://books.google.com/>



QL
444
A7
B3

A HISTORY
OF THE
BRITISH
SESSILE-EYED CRUSTACEA.

BY
C. SPENCE BATE, F.R.S., F.L.S., ETC.,

AND
J. O. WESTWOOD, M.A., F.L.S.,
HORN PROFESSOR OF ZOOLOGY IN THE UNIVERSITY OF OXFORD, ETC.

IN TWO VOLUMES.—VOL. II.

LONDON:
JOHN VAN VOORST, PATERNOSTER ROW.

M.DCCC.LXVIII.

10

LONDON:
PRINTED BY WOODFALL AND KINDER,
MILFORD LANE, STRAND, W.C.

12-27-38
Rec'd
1844

INTRODUCTION.

THE term "Sessile-eyed" has been applied to the order of crustaceous animals forming the subject of this work in contradistinction to that of the "Stalk-eyed" order, of which Professor Bell has given an account in a preceding volume of this series. The name, with its Greek equivalent, Edriophthalma, was first given by Dr. Leach, and has been recognized by all subsequent naturalists. It must not, however, be understood to characterize every genus that should be classed in the order. Among the *Isopoda*, the genera of *Tanais*, *Paratanais*, *Apseudes*, and *Munna*, have their eyes fixed on pedicles. In the first of these genera, the structure differs so much in character from that of the normal *Isopoda*, that it has been classed with the Stalk-eyed Crustacea by Fritz Müller and Anton Dohrn. In this work we have placed it in an intermediate position between the *Amphipoda* and the *Isopoda*; its most important structural characters holding a position nearer, but intermediate in relation between, these two orders than they bear to the Stalk-eyed Crustacea. While, therefore, the eyes may be considered (as they have been since the days of the Swedish naturalist, Linnæus) as a ready and convenient means of classification, separating one great division from another, this character must be received as only an approximation to a

general law. So common, however, is it, and so ready of discernment, that it will probably be retained, even after a more perfect, but less readily detective, system of natural arrangement be discovered.

The term was at first applied so as to embrace all Crustacea that were not contained in the Stalk-eyed order, with the exception of the *Cirripedia*. It is still so retained in Mr. Dana's "Classification of Crustacea," and consequently embraces a large number of forms, exclusive of those described in this work, which vary so considerably from each other, that we believe it is neither natural nor desirable to group them under one definition. In the present volumes, we speak of the Sessile-eyed Crustacea as constituting a legion between the Stalk-eyed (Podophthalma) and the Entomostracous Crustacea. But the great difference of character in some animals of this legion from the others induced Latreille to divide it into two orders, naming them respectively after the structure of their locomotive appendages, *Amphipoda* and *Isopoda*. Another division was proposed by the same author, and very generally adopted, namely, the *Læmipoda*, or *Læmodipoda*. The animals that constituted this supposed order differ from the normal species of the *Amphipoda* only in the absence and deficiency of parts; consequently, in this work, they are viewed as an aberrant group of the order; whereas Latreille first placed the animals of this group in the order *Isopoda*,* and Lamarck united them with the *Amphipoda* and *Isopoda* as members of one family only, under the name of *Arthrocephalés*, or *Capités*. Dumeril, in his "Zoologie Analytique," united the *Amphipoda* with the *Stomapoda*, the point of similarity being the separation of the head from the body.

The term *Tetradecapoda* has been proposed for the

* Dictionnaire d'Hist. Nat.

Sessile-eyed Crustacea by M. Blainville, in contradistinction to that of *Decapoda*: the one being defined by having fourteen legs, the other having only ten. But this, upon the most superficial examination, will be found to be the most imperfect character, not only in usefulness, but also in appearance. Not only all the *Stomapoda*, but even the *Macrura*, below the family of *Palæmonidæ*, possess fourteen fully developed pediform limbs; and even in the *Brachyura* and *Anomura*, the anterior appendages that protect and supply the mouth are legs altered for a necessary purpose, and not really oral appendages; consequently, the distinction in structure that the two separate names would lead a student to expect, does not exist. The only true *Decapoda* are *Caprella* and *Anceus*, and these belong, in the present system of classification, to the *Tetradecapoda*.

The term *Choristopoda*, or separate-footed, has been applied by Mr. Dana, who uses it as synonymous with *Tetradecapoda* of Blainville and our term of Sessile-eyed, over which it appears to possess no advantage, without which it is unwise to add to the already too numerous list of synonyms. Thus it will be perceived that, in our consideration of the orders treated of in this work, we consider that the Sessile-eyed Crustacea bear a nearer structural affinity with the Stalk-eyed Crustacea than with the *Trilobita*, *Entomostraca*, and *Rotatoria*, which Mr. Dana unites into the one division under the term of Sessile-eyed Crustacea.

The classification that we have adopted nearly resembles the system of arrangement adopted by Milne Edwards in his "Histoire des Crustacés;" but, in his classification, the aberrant *Amphipoda* are admitted to a rank of equal importance to that of the *Amphipoda*, whereas certain very exceptional forms of *Isopoda* are only distinguished as a separate family of *Isopoda*.

The aberrant group of *Isopoda*, although containing, and perhaps based upon, the most characteristic genus of Dana's supposed order of *Anisopoda*, yet must not be considered synonymous with it, since all the parasitic forms that possess such extremely aberrant characters in the adult females, possess the true character of the normal *Isopod*, both in the young and adult male. Thus the genera *Arcturus*, *Bopyrus*, and the rest of the parasitic *Amphipoda*, we have classified with the normal *Isopoda*. Nor can we think that the only feature that assimilates *Arcturus* to the *Amphipoda* (the forward direction of the second pair of pereiopoda), can be considered of sufficient importance to narrow the distinction between it and the *Amphipoda*, whereas other characters of greater importance induce a natural separation that is strongly marked.

The consideration of the structure of the Sessile-eyed Crustacea has, until recently, but little attracted the attention of zoologists. The observations of Loven, Lilljeborg, Goës, De la Valette, Grube, Fritz Müller, Anton Dohrn, Schöbl, Schiödte, and others, have done much to show the large amount of novel and interesting subjects of biological knowledge that have been, and still are to be, developed by the study of this hitherto much neglected class of animals.

The structure of these animals, though offering a very palpable distinction from the higher forms, is indubitably formed upon the same common type. So clearly can this be demonstrated, that we are somewhat surprised to find that Mr. Dana ("United States Exploring Expedition," vol. i. p. 1404) should say that "they have not a macrural characteristic, but have a body divided into as many segments as they have legs (hence our name *Choristopoda*); the antennæ, legs, and whole structure are distinct in type."

That every segment has its appendage is a law common to all Crustacea. In the Stalk-eyed order, the development of the cephalon is carried to a monstrous extent as a shield or carapace, covering and protecting, in some cases, all the segments of the pereion. When the carapace is so developed, the necessity for perfect segments in the latter does not exist, consequently the dorsal surface is wanting; but the lateral portion is always present. In the Sessile-eyed Crustacea this enlargement of the cephalon does not exist, and the absence of a carapace permits the development of the dorsal surface of the segments of the pereion. A careful examination of the appendages of the head will clearly show the same number of segments associated together as is found to exist in the macrural forms, consequently the head or cephalon in the Sessile-eyed Crustacea homologizes with the carapace in those Crustacea that have their eyes supported on foot-stalks. Gradually, from the *Brachyura*, it decreases through each succeeding order, and this, apparently, in relative degree with the separation of the nervous system into separate ganglia, obedient to a common law of depreciation, which in the Sessile-eyed Crustacea appears to reach a lower limit in the *Isopoda* than in the *Amphipoda*.

The appendages that are supported by the cephalon are various in form, and generally associated with the senses.

The first, or most anterior pair, are the eyes, which, from the circumstance of being closely impacted within the dermal skeleton, give the name of Sessile-eyed to the legion, as above mentioned. This position is not invariably the case, since in the genera *Tanais*, *Paratanais*, *Apseudes*, &c., the eyes are carried on elevated stalks. In the *Isopoda* these organs appear to be more perfectly developed than in the *Amphipoda*, except, perhaps, in *Hyperina*, where their monstrous development deprives

the head of its normal form. In the *Isopoda* generally, the lenses of the eyes are well developed, and lodged in the texture of the skeleton of the animal, which is frequently thinned out to an extreme tenuity, and marked with numerous facets, corresponding with the many lenses belonging to the organ. In the *Amphipoda*, the lenses either are not so numerous or are less apparent, and the dermal tissue that covers the organ is thick and unchanged in character. This condition is carried to the greatest limit in the *Phoxides*, *Ampeliscides*, and those *Gammarides* that are inhabitants of deep and dark wells, where no rudiments of eyes are apparent, except in the presence of some coloured and ill-defined pigment cells, which in the *Phoxides* coalesce into a single organ. In the genus *Ampelisca* this pigment of colouring is associated on each side with two solitary lenses, that appear to be built into, and form part of, the dermal covering.

It appears to be a law in the decreasing structural importance of Crustacea, that the segment supporting the appendages shall disappear before the appendage that it supports. In the Sessile-eyed legion, the eyes alone remain, the segment and the articulating portion of the appendage not being developed; the eyes are developed in most families so deeply within the head, that they generally appear to be behind the antennæ, and sometimes, as in *Phoxus*, at the extremity of the frontal rostrum; in others, as *Erichthonius*, on a projecting lobe of the head, situated between the two pairs of antennæ, in which position, owing, probably, to the insufficient depth of structure, the eye is borne on the internal surface, where it is lodged as a protuberance. But whatever may be the position of these organs, the variable-ness of situation can only be consistent with certain advantages under peculiar conditions.

In the young animal the number of facets is fewer in

the eye than in the adult state. In the genus *Gammarus*, the number of lenses in the young is first eight or ten, whilst in the adult they number from forty to fifty.

The superior or first pair of antennæ we consider, contrary to the opinion of Mr. Dana, to be formed on the same type as those of the *Macrura*. Each of them consists of three distinctly formed joints and a flagellum, with sometimes a more or less important secondary appendage. We have long since expressed our opinion that in these organs lies the seat of auditory consciousness, and we are still inclined to retain that opinion. We are aware of the elaborate experiments of Dr. Von Hensen, which tend to demonstrate the existence of auditory cilia on several parts of the animal, as the superior antennæ, (in which Professor Huxley was the first to demonstrate, in some exotic *Macrura*, the presence of highly refracting otolithes,) on the inferior antennæ, as well on the caudal appendages as in the external branch of the posterior pleopoda, on which Van Beneden has discovered, and we have seen, what appear to be well-formed otolithes, of the same type as those found in the first joint of the anterior pair of antennæ in *Mysis*, &c. But we have always attributed to certain very delicate membranous cilia of various forms, found on the primary flagellum only of the superior antennæ, and present, under normal conditions, in nearly every family of Crustacea, the power of conveying impressions of sound. But these membranous cilia are very distinct from the auditory hairs of Dr. Von Hensen.*

That the superior antennæ are, in their most normal development, purely aquatic organs, we see in the depreciation of their character in the partly marine genera

* An elaborate memoir on the auditory organs of the Crustacea, by Dr. V. Hensen, was published in *Zeitschr. f. Wissensch. Zoologie*, xiii. Bd. 3. Hft. 1863, an abstract of which may be seen in the *Zoological Record* for 1864.

Orchestia and *Talitrus*, and their rudimentary condition in the terrestrial *Isopoda*.

The inferior or second pair of antennæ are formed on the simplest character of the *Macrural* type, and consist of a peduncle with five joints, of which the first two, (the homotypes of the coxa and basis joints of the true leg,) are very closely associated, and carry the olfactory denticle. In the higher groups, the two basal joints are fused together, and often with the nearest part of the segment to which they belong. Sometimes, so perfect is the union, that not the slightest trace of the relation of one part to another is capable of being detected. This complete association of the appendage with the body of the animal lessens with the degradation of the creature, until we find the five separate joints distinguishable from each other and from the body of the animal.

The denticle at the base of the second pair of antennæ in the *Amphipoda* (Fig. 1), homologizes with a perforated

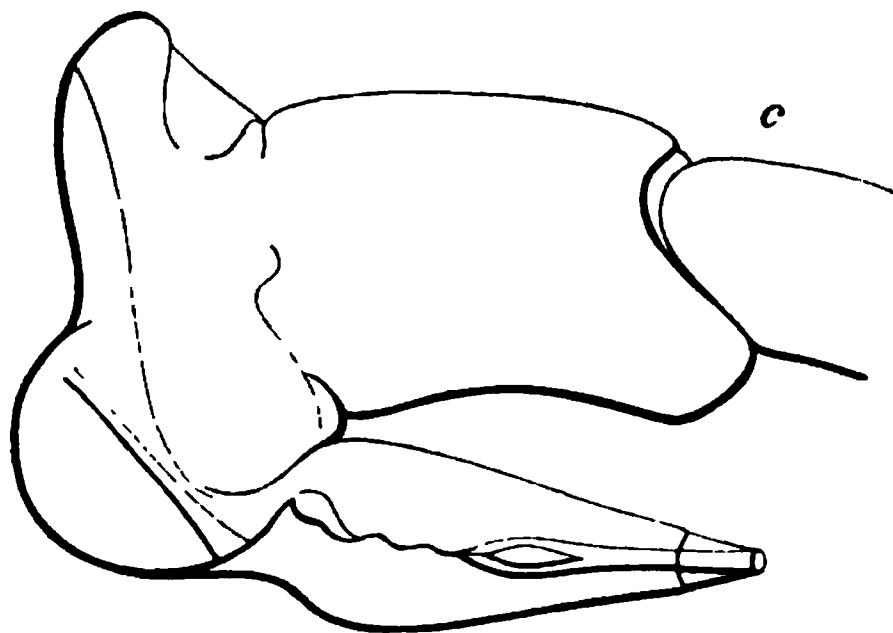


FIG. 1.

tubercle situated on the ventral surface of the cephalon in the *Brachyura*, laterally anterior to the oral apparatus, and indeed covered by some of the appendages, in the higher groups of the class. The denticle in the *Amphipoda*, upon close examination, appears to have an open extremity, through which a cylindrical tube, retained in its place by membranous ligatures, protrudes. This tube closes at the

internal extremity rather suddenly, and encloses the elongated bulbous extremity of a nerve-thread, that proceeds from a second bulb or nerve-ganglion implanted at the base of the denticle. This denticle, though frequent, is not invariably present. In the genera *Orchestia* and *Talitrus*, the two basal joints of the antennæ are built into the anterior wall of the cephalon, so as to be generally mistaken for it; while in others, as also in the *Isopoda*, every trace of the denticle is lost (Fig. 2).

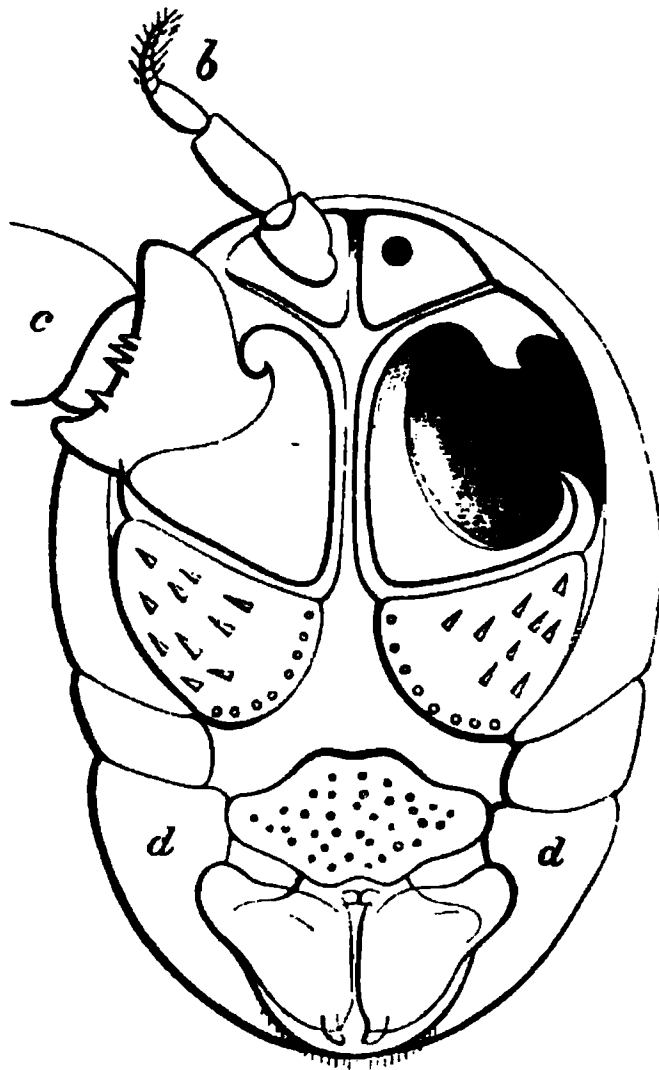


FIG. 2.

There is no secondary appendage to the inferior antennæ, and, with the exception of the squamiform plate in the *Macrura*, it is never found in Crustacea; nor is it invariably a macrurous condition, since in some genera it is entirely absent; and even in *Palinurus*, a most typical form, it is lost as an appendage, being distinguishable only in the outline impressed in the walls of the fourth joint of the antennæ.

The flagellum in all Crustacea originates, in the upper antennæ, after the third perfect joint; in the lower, after

the fifth ; and in every case the secondary appendage, whether in the form of a scale attached to the lower, or a filamentary appendage, or several, invariably in upper and lower alike arises from the distal extremity of the third.

This appears to be a very constant condition with all the appendages of the cephalon, pereion, and pleon. The most frequent exception exists in the first joint or coxa, as exemplified in the branchial appendages and the ovigerous plates of the female *Amphipoda* and *Iso-poda*. According to our experience, whenever any secondary appendage is developed from the second joint or basis, it exists more as a rudimentary effort than as a true organ. After the third joint, we are not aware that any secondary appendage is ever produced, though in some genera, as in *Palæmon*, the primary flagellum of the anterior antennæ occasionally divides or sends off a smaller one.

The flagellum in the Sessile-eyed Crustacea is generally multi-articulate. It attains its most filamentary character in the sub-family *Gammarides* ; but in some genera many, and sometimes all, the numerous articuli coalesce into one or more joints, as in *Podocerus*, *Corophium*, *Chelura*, the terrestrial *Isopods*, &c., in all which cases they become organs assisting in climbing and grasping. Unlike the superior antennæ, the inferior pair appears to be always present, and we only know of their being reduced to an immature condition in those Crustacea that pass their lives as parasites upon others, as the *Bopyridæ*, *Hyperiidæ*, and *Cyamus*, a circumstance that induces us to believe that the second pair of antennæ is the seat of a sense which undergoes but slight modifications to enable it to be equally distinguishable whether in air or water, since the *Isopoda* and *Orchestia*, in which the antennæ are well developed, are terrestrial.

. The oral apparatus in most Crustacea is a somewhat

complicated series of organs. It is built up of many separate pairs of appendages, those belonging to the higher groups of Crustacea being the most numerous. In the Sessile-eyed orders, the mandibles are separated from the second or posterior pair of antennæ by the ventral surface of the fourth or mandibular segment, and a protuberance that, from its position, is called the labrum, or anterior lip.

In the *Amphipoda*, the epistome is generally placed vertically, and occasionally produced anteriorly into a sharp spear-like process. In many, however, as also in the *Isopoda*, it exists as a plate that gives strength and solidity to the fulcrum on which the mandibles rest.

The labrum is divided into two parts, the lower of which moves on the upper by a slight hinge, and assists in perfecting the shutting of the mouth. The free margin is generally clothed with short hairs, often of club-shaped and deformed appearance.

The mandibles are powerful organs, impinging against each other at their extremities, the biting edge being in the median line. In the Sessile-eyed Crustacea, they bear a near resemblance to the same appendages in the larval condition of the highest order of Crustacea. The anterior or biting margin of the mandible is generally divided into several short and strong denticles, though in some genera it is smooth and even. Within the denticular margin a second process generally exists, a smaller repetition of the first, and which commonly, when present, is attached by a movable joint. Near the centre of the mandible is a large internally projecting process, that corresponds with and meets a similar process in the opposite mandible, and is evidently adapted for mastication, and may with propriety be named the molar tubercle. It forms, generally, with the anterior or

incisive margin, the two extremities or horns of a crescent. The second, or articulated process, is situated between the two, but somewhat nearer the anterior margin. It appears to be able to assist in carrying the food from the one point to the other, from the biting to the grinding surfaces, between which and the molar tubercle are frequently a row of strong and curved spines that facilitate the process.

The mandibles are moved by powerful muscles attached to the inner surface of the dorsal part of the cephalon, corresponding with the homological parts that are attached to the inner dorsal surface of the carapace of the higher Crustacea.

The surface of the molar tubercle is granulated with rows of minute denticles that are only visible under a strong magnifying power. In some species, a long and slender ciliated filament is appended to the margin of the tubercle that may be associated with the sense of taste.

The mandibles are no exception to the fact that all appendages are but modified legs. In all Crustacea, we think that it can readily be demonstrated that the mandible consists of the first three joints being closely ankylosed. The small appendage, that generally consists of three freely articulated joints, represents the fourth, fifth, and sixth joints; the seventh, or dactylos, being seldom present. An homological examination of the genera *Nebalia* and *Pontia*, with *Homarus*, together with the homotypical parts in other appendages in the same animals, we think will readily confirm this opinion. The small three-jointed appendage to the mandible is wanting in but few genera, excepting in the terrestrial *Isopoda* and *Amphipoda*. In aquatic species it is, with few exceptions, always present, and appears to be of efficient use in directing floating material towards the mouth.

In some parasitic families these organs undergo an extreme amount of modification. This is much more exaggerated in the *Isopoda* than in the *Amphipoda*. Among the *Cyami*, the oral appendages are all reduced and somewhat modified, but in the *Cymothoidæ*, *Bopyridæ*, and *Anceidæ*, among the *Isopoda*, they appear to lose much of their normal character, and fulfil the office of a sucking apparatus. In the formation of this organ one or more pairs of the appendages may be implicated, as is shown in an elaborate memoir by Schiödte* on the subject. The manner in which the organ is developed in *Ione* from the mandibles, we have described at page 253, vol. ii. of this Work.

In the *Anceidæ*, the appendages of the mouth in the young stage are sharp and lanceolate, the sucking organ being apparently modified from the labrum, where, as in the adult animals, the oral aperture, with the supplying appendages, are lost, or converted into members useful for other purposes.

In the genus *Brachyscelus*, and others of the family *Platyscelidæ*, the appendages of the oral apparatus are reduced to a single pair of membranous leaf-like organs; nor have we been enabled to trace any different character of organ to take the place of the lost ones. Both in the adult and young animal, the mouth appears to be reduced to a rudimentary and simple character: an aperture with the probable power of opening and closing at will being the most that we have been enabled to determine.

The first or anterior maxillæ (Siagnopoda) are separated from the mandibles by a posterior lip, which differs in the *Amphipoda*—or at least in some genera—in being cleft longitudinally in the median line, and is termed the labium;

* Natur. Hist. Tidssk. 1866, p. 168—206.

it appears to be capable of being slightly moved, and probably assists the mandibles in the process of manducation. There are three pairs of Siagnopoda, the two anterior of which are extremely delicate foliaceous appendages, whilst the third is much more robust, yet still possessing a foliaceous character, particularly as regards the three or four basal joints. In some genera, as in *Sulcator*, some of the plates, particularly of the two anterior pairs, are folded so as to become two or three parallel leaves, one of which, on the first pair in *Sulcator*, is developed into a prominent lobe, containing large nucleated cells. Of the office or use of this gland-like organ we can offer no suggestion, not having met with any analogue in the order.

The two anterior pairs, the maxillæ of authors, vary somewhat in their form in genera, and very much between the *Isopoda* and *Amphipoda*. In the parasitic species of both orders, they are defective, and sometimes wholly wanting.

The third Siagnopod, or first maxillipede of authors in these orders, is a true cephalic appendage, and covers the organs of the mouth as a protecting operculum.

These last three pairs of appendages are concentrated about the mouth, the segments to which they belong being represented by the ventral portions only, and these are closely fused together, from the sides of which, in the genus *Talitrus*, originate two bony processes, that meet, without uniting, near the internal centre of the head, there spreading out into flattened plates, from each of which a thin and somewhat delicate process is directed anteriorly and slightly upwards; the stomach is supported by them in its position. This osseous internal arch, that we described in the British Association Report "On the British *Edriophthalma*," 1855, Professor Huxley has, in his lectures at the Royal College of Surgeons, published in the

Medical Times and Gazette, vol. xxxvi. p. 467, 7th November, 1857, named the *Endophragmal arch* (Fig. 3, En.).

c

FIG. 3.

The seven segments which succeed the cephalon, or head, are, in the higher orders, protected by the carapace. This becomes gradually smaller in the descending series, until, in the Sessile-eyed Crustacea, each segment is exposed and developed into a perfect ring, analogous in appearance to the segments of the pleon in the *Macrura*. The several appendages that belong to the segments of the pereion are locomotive in their character, some being perfectly natatorial or ambulatory, others adapted for climbing and grasping. In this respect the two anterior pairs in the *Amphipoda* are most constant in their adaptation. The probability is, that these last are never in the *Amphipoda* used, except for carrying food to the mouth, or more rarely for climbing, or occasionally grasping the female. In this they are found to possess

b

a feature that, with the exception of the *Isopoda*, is common to most Crustacea, even including the aberrant *Isopods*. We have thought it convenient to describe them under a name distinguishing them from the true ambulatory legs, although by doing so we must include some genera of *Isopoda*, where they assimilate to and fulfil the conditions of true walking-legs. In the *Brachyura*, the gnathopoda are developed, so as to serve chiefly as protecting the oral apparatus. In the *Macrura*, they assume a pediform appearance, and are used in seizing and holding food. In the *Stomapoda*, the *Squillidæ* have them developed into formidable prehensile organs. This change takes place gradually from the highest Crustaceans to the *Amphipoda*. The character is still increased in some of the aberrant genera, until it becomes a perfectly didactyle chela. In the *Isopoda*, the prehensile character may be said to be lost, presenting itself only occasionally in the anterior pair, in the male animals.

The five remaining pairs of walking-legs (the pereopoda) homologize with the five pairs of legs in the Stalk-eyed Crustacea, that give the name of *Decapoda* to the order. These are produced on a somewhat different plan from the walking-legs of the Stalk-eyed Crustacea, the modification, as it appears to us, taking place in accordance with certain necessities that have arisen from the depreciation of their general development. The two anterior pairs of legs, or gnathopoda, are developed upon one type; the two succeeding pairs, or first and second pairs of pereopoda, on a second; and the last three on a third.

The normally developed appendage of every kind in Crustacea consists of seven joints. In the *Brachyura*, the first, or coxa, is anchylosed with, and forms part of,

the sternum. In the *Macrura*, it also forms part of the sternum, but the separation is distinguishable by a free and movable articulation. In the Sessile-eyed Crustacea, the coxa is more laterally situated, and very firmly attached, without being fused to the segment of the body. With few exceptions, it is developed into a broad and scale-like joint, and is so large in the *Stegocephalidæ* that it covers the greater part of the animal. The object of this development is evidently to cover and protect the branchial appendages, when situated beneath the pereion. These scale-like coxæ have been considered as parts of the segments of the body of the animal to which the legs belong, and are described under the name of epimera, or side-pieces, by Professor Milne Edwards.

There is a peculiar tendency in the *Amphipoda* for the joints of the legs to be produced in a scale-like form. Besides the coxæ, the *basis*, or second joint of the three posterior pairs of pereiopoda, are almost always so developed. In *Orchestia*, the males in some species have the carpus and posterior pair of pereiopoda enlarged; in *Podocerus* and *Cerapus*, the two anterior pairs have the basis so produced; but in *Sulcator* this predisposition appears to reach the culminating point, where it is apparent in almost every joint of the appendages of the head and body.

The next division of the animal is that which we denominate the pleon. It consists of seven segments, as in each of the former divisions, and carries three kinds of appendages. The segments generally resemble those of the pereion, and, like them, carry on each side squamiform coxæ, which Professor Milne Edwards has again mistaken for epimera, or side-pieces, belonging to each respective segment. These are, both in the *Amphipoda* and *Isopoda*,

generally fused closely with the dorsal surface of the segment; but in the genus *Apseudes*, as we have shown in fig. *p*, page 148, vol. ii., they are free. Here we have a distinct exposition of the relation which the squamiform side-piece holds both to the segment and the movable bifurcate appendage. The segment is distinctly separated from the squamiform side-piece, which, articulating with it, forms the first joint of the pleopoda or swimming-leg, and is developed into a large scale-like process, to the base of which the second joint is articulated, from whence is suspended freely a third, which in its turn supports the two free plates which form the terminal appendage of the anterior pleopoda. In the *Isopoda*, as well as the *Amphipoda*, this interpretation illustrates the relation of the parts of the pleopoda to the segments of the pleon. The forms of the pleopoda may and do change, according to the law of modification of parts, to suit their requirements; but under whatever condition they may exist, they consist of three normal joints, more or less fused together, and with the segments of the pleon and a depreciation of the four terminal joints into one or a pair of movable plates, as in the *Isopoda*, or articulated flagella, as in the *Amphipoda*.

The three anterior pairs in the *Amphipoda* are developed upon this type; the two succeeding have the double appendages stiff and unyielding, and the posterior is generally variable in the different genera. In the *Isopoda*, the four anterior pleopoda are developed upon one type, while the fifth is converted into an operculum. Some variation of the anterior pairs also takes place in relation to the sex of the animal. The last, or twenty-first segment, differs from the rest in most Crustacea by not carrying any appendage. To this we know of but one exception among the Crustacea, and that is in a genus in the family

Mysidæ, discovered by Mr. Norman. The telson in the Sessile-eyed Crustacea is generally an abortive, and frequently a rudimentary, part. In the *Isopoda*, except in the genera *Apseudes* and *Anthura*, it is always fused with the preceding segment.

The composition of the dermal skeleton is, in all Crustacea, the same. In the Sessile-eyed order the texture is very thin, and seldom consolidated into a firm structure, except in certain parts of some few genera where strength is required, as in the chelæ of large-handed species. This circumstance offers the advantages of enabling the observer to examine the internal structure of the animal without the necessity of dissection. During the life of the animal, we are enabled to trace the currents of circulation of the blood, the motion of the cardiac vessel, and the position of the internal organs in relation to each other.

This delicacy of the structure also enables us to discover the very diverse and varied arrangement of the material of which it is built up, and demonstrates (contrary to our anticipations) that in species often closely allied, there is a very distinct appearance in the microscopic structure. It may prove to be of some importance in determining species, but care should be taken that the several specimens examined should be taken from the same part of the skin of each animal. We have illustrated many of these varieties of structure throughout the work, in connection with the animals to which each belongs.

Frequently, besides the markings that illustrate the manner in which the skin is built up, there is another that is not always constant, consisting of a series of small perforations through the tissue, which in some species assume a waved appearance, as may be observed in the genus *Ampelisca*.

Although we believe that the microscopic examination of the skeleton in these animals would frequently facilitate the determination of doubtful species, yet it is a condition that is not to be trusted to alone, inasmuch as it is not unfrequently found that similar appearances are repeated in very distinct genera. Examples of this may be found on comparing the structure of *Megamaera Othonis* with that of *Chelura terebans*.

The form and structure of the hairs that are found on these animals, when microscopically examined, are of a very distinct and different character. They not only vary in separate species, but differ in several parts of the same animal. In *Sulcator* there are no less than twelve varieties. Some are plain, stiff, bristle-like spines of various lengths, which are generally attached to the margins of the limbs. A second variety, longer in general form, fringed on one side with a series of fine, straight, teeth-like processes, possessing a rake-like character, is attached to the third siagnopod ; as is also

A third, that differs from the preceding in having the teeth bent in a curve directed to the base.

A fourth is found on the carpus of the second pair of gnathopoda. In this position are also two varieties, which originate from closely approximating bases. One is long, slender, and clean to the tip, where a few exquisitely fine cilia appear, which give to the extremity a bulbous appearance, that can be resolved only with a high (700) magnifying power. The other, or

The fifth, is short, broad, flat, terminating in a point that is sharply bent upon itself ; the lateral margins are likewise furnished with a series of sharp denticles, ranged on each side, pointing to the base for about two-thirds of its length.

A sixth is found on the propodos of the same appen-

dage; comprising two forms moulded on the type of the two preceding; the shorter changing the hooked extremity for a bulbous termination, and the shaft being armed with teeth on one side only.

A seventh exists on the mandibular appendage: it is straight, enlarged and rounded at the apex, and serrated on one side; while

An eighth differs from the preceding in being more robust, slightly turned at the extremity, and smooth along the margins, excepting a single short, straight, distally directed cilium.

A ninth resembles the sixth, but wants the serrated margin, and carries on the convex side a fine cilium. This variety is found on the first pair of gnathopoda.

The tenth, eleventh, and twelfth varieties are plumose, and found mostly on the second pair of antennæ, though a few are present on several other parts of the animal. One is short and obtuse, being crowned with numerous radiating cilia. It is to this variety that we understand Professor Hensen attributes the power of hearing.

This great variety of form in the hairs of a single species is not constant. In the genus *Talitrus*, there is but a single form of hair, which is but little modified in the various parts of the animal. It is short, stiff, and blunt, and exhibits under the microscope a tendency to a spiral condition for about one-fourth from the extremity, at which distance a second but smaller process exists, so that the hair might be characterized as being forked, but for the unequal proportion of the two branches. This kind of hair is by no means rare in the *Amphipoda*. Those found in *Orchestia*, *Talorchestia*, *Nicea*, *Gammarus*, &c., are but modifications of the same form. This great variation in the form of the hairs is more or less common to all Crustacea. Those in *Carcinus mænas* have been

described and figured by Dr. McIntosh in the "Linnæan Transactions" for 1862, p. 79. The hairs are not only various in form, but sometimes they will be found constant in number. Thus, in the genus *Phoxus*, we have found the number of hairs on the coxæ of the three or four anterior pairs of legs to be constant in the respective species.

EXUVIATION AND REPRODUCTION OF LIMBS.

The power of Crustacea to throw off their skin and replace it by a new one, has long been a recognized fact in all the higher orders. It is, however, on the authority of Mr. Couch, stated by Mr. Bell, in a note to his introduction to the "Stalk-eyed Crustacea," p. lxi., "that the families in which the eyes are sessile in their adult growth . . . do not exuviate, or voluntarily throw off their limbs."

These Crustacea, however, like their higher congeners, renew their integumentary tissues periodically. This is equally true with regard to the alimentary canal, which is cast in connection with the skeleton. The animal shows no appreciable difference in its habits at the time immediately anterior to its throwing off its exuviae. It swims about very actively until the hour of moulting arrives, when it seeks a place of comparative security, where it may remain uninterrupted the necessary length of time for the completion of the process.

In this position it grasps with the anterior pair of gnathopoda some fixed and conveniently secure material for an anchorage. Here the labour is commenced, and, judging by the quietness and rapidity of the process, appears to be one of no great discomfort. During the

operation, at almost any stage, the animal, if disturbed, is capable of removing itself to a more quiet and secure place.

The process appears to be the result of an internal growth of the animal, which becoming too large, the skin splits at the margin of the dorsal and sternal arches of the three anterior segments of the pereion, the inferior arch carrying the legs, inclusive of the coxæ.

The anterior segment of the pereion extends over the posterior margin of the cephalon. At this point the attachment is broken anteriorly, and the lateral disunion of the three anterior segments allows their upper surfaces to be raised as a movable lid, through the opening of which the animal escapes from the old integuments. With some exertion, the posterior portion of the body, together with the limbs, are withdrawn, after which the head and the anterior members are removed, and the entire animal is free from the old exuvixæ, which, resembling a dead individual, is left, attached to its old position. Unless disturbed, the animal, which is now extremely soft, generally rests for some time, as if exhausted, near the cast-off skeleton. Upon being disturbed, it is capable of swimming away immediately.

Mr. Harry Goodsir, in the *Edinburgh Philosophical Journal* for 1842, has described the process of exuviation, as observed by him in the genus *Caprella*.

He says that the animal, previously to the commencement of the process, "lies for a considerable time languid, and to all appearance dead. At length a slight quivering takes place all over the body, attended in a short time with more violent exertions. The skin then bursts behind the head in a transverse direction, and also down the mesial line of the abdominal surface; a few more violent exertions then free the body of its old covering. After

this the animal remains for a considerable time in a languid state, and is quite transparent and colourless."

The new creature is a perfect representation of the old one, slightly enlarged. According to our observations, every hair is produced complete. We have often seen them, convoluted and bent up within the old case, from which they only wanted to be freed to assume the erect position of the perfect hair. It has, however, contrary to our anticipation, appeared that all the hairs are not developed within each corresponding one. We have frequently observed them as a second armature, independent of the old one. This remark is particularly distinguishable in the teeth that fringe the first two siagnopoda. These have generally a dentated and forked character, which might be injured in their removal from the old and hard tissue of the rejected skin, an accident that not unfrequently befalls the branchial sacs, which are occasionally torn off and retained behind in the old case.

The power of Crustacea to throw off any of the limbs upon receiving an injury, and sometimes in consequence of fright, is well known in relation to the higher orders. The manner in which this is done has been described by Dalyell, Goodsir, and ourselves. It certainly is a remarkable power and law of reproduction, and which always takes place at the same homotypical position in every limb—that is, between the coxa and the next succeeding joint. The wound that is caused by this sudden rupture is simultaneously glazed over by a thin membrane, which must be very suddenly formed, and probably is the amputating power. Observers have very generally added as an appendage to the above interesting fact, that it is exceedingly fortunate that there is this power of voluntary amputation of the limbs, for otherwise, in consequence of the non-contractile character of the dermal covering, the

animal, upon being wounded in either of the limbs, would of necessity bleed to death. That such would be the case would appear to be extremely probable, but, like all negative evidence, is only of value in the absence of direct testimony. In the Sessile-eyed orders the animal appears to want the power of voluntarily throwing off any of its appendages, no matter how severely it may be wounded. If a leg be cut off, or in any way injured, the wound very soon after becomes cicatrized with a black scar, which remains until the next exuviation of the animal, when the entire limb is thrown off with it, and a new one commences growing.

TASTE AND DIGESTION.

The sense of the enjoyment of food, even in the highest types of the animal kingdom, exists rather in the power of parts to receive impressions than in the presence of any especial organ for the purpose. Arguing, therefore, from analogy, we should suppose that the sensation of taste in the lower animals (such as the Crustacea, and other groups in which mastication is of an imperfect character), must necessarily be rather a faculty peculiar to the mouth in general, than the result of any especial organ adapted for the purpose.

From the mouth the œsophagus leads directly to the stomach. The passage is very short, being directed upwards and forwards; it enters the stomach at the infero-anterior margin, and, as in all Crustacea, is within the limit of the cephalic region.

Just within the anterior opening of the stomach are situated two rake-like organs, the teeth being placed in a row on an arched base; they are slightly curved and dentated on the margins. They are so placed as to have

the points directed inwards, so that food can readily pass into, but cannot return again from, the stomach. The teeth on each side appear to correspond, so that they probably play an important point in tearing and lacerating the food as it passes into the stomach. Posterior to this

FIG. 4.

tritulating apparatus there exists four leaf-like plates, fringed with long and powerful cilia. These are attached to the lateral walls in pairs, one anterior to the other; immediately above the second or posterior pair, apparently in a chamber of its own, is a gizzard-like apparatus. We observed this most distinctly developed in *Sulcator* and *Talitrus*, and we believe it to be present in all the *Amphipoda*, and we take it to be the same appendage which Bruzelius and Loven figure and describe as the "mellanbalkan," which is situated within the "blind-säcklikt organ," and not, as their figures* would lead one to believe, on the floor of the stomach.

* Öfversigt af K. Vetensk. Akad. Forhandl. 1859, pl. i., figs. 1, 3, 8.

This apparatus, under a high magnifying power, is seen to consist of several closely packed rows of fine strong short hairs, very commonly arranged together in the form of a heart, the apex of which, directed anteriorly, is truncated. This appears to be the most general appearance, though in various genera it is different in form. Its appearance suggests its capability for triturating and grinding food, though it is curious that two such kinds of apparatus should exist at each end of the stomach, the one at the œsophageal entrance, the other near the pyloric outlet. The cavity in which the latter is placed has the walls thickly covered with very short hairs.

In the genus *Talitrus*, posteriorly to this apparatus are placed two long cæca, one on either side of the posterior opening of the stomach. These cæca are not universally present in other genera. They are delicate prolongations of the walls of the stomach, and gradually narrow towards their free extremity. They probably supply the stomach with a gastric juice. Still more posteriorly, at the point where the stomach terminates and the alimentary canal commences, are situated from four to six long cæca-like lobes, filled with hepatic cells. These are attached to the inferior surface, forming the liver, and are carried parallel with the alimentary canal. In the *Amphipoda*, as illustrated in *Gammarus*, the liver consists of four sub-equal lobes; in the *Isopoda*, as exemplified in *Ligia*, it is formed of six lobes, two of which are much longer than the other four, and have a slightly waved or tremulous-looking appearance towards the free extremity. From the pyloric orifice of the stomach the alimentary canal in all Crustacea passes, without curve or inflection, straight to the anal termination under the telson. To this we know of but a single exception, and that on the authority of Professor Alman, who says:—
“In *Chelura*, the alimentary canal is so arranged as to

shot one part within another, so as to admit of the head being projected forward, that the animal might eat its way into the wood that it penetrates." This we have not been able to verify, nor can we see the necessity for the disarrangement of the stomach with all its attachments, when a prolongation of the oesophageal canal would enable the animal to accomplish the work on far easier conditions.

The structure of the alimentary canal is longitudinally fibrous. In the genus *Ligia*, a little anterior to the anal termination, a series of transverse muscular bands surround it without uniting on the under surface, and probably fulfil the office of sphincter muscles.

About two-thirds of the distance between the stomach and the telson, one or two appendages are attached to the alimentary canal in the *Amphipoda*. We say one or two, because we have distinctly dissected out two in *Sulcator* (Fig. 5), but have failed to determine more than one in

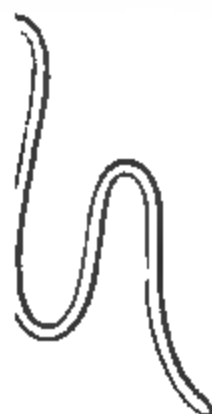


FIG. 5.

Gammarus (Fig. 6), *Mæra*, and other genera. The organ is free at one extremity, and is borne in a forward position, resting on the dorsal surface of the primævia. It is more important in appearance in some *Amphipoda* than in others; in *Sulcator* it is very long. We have never seen it in any of the *Isopoda* that we have examined, but, as far as our experience supports us, it is present both in the male and female *Amphipoda*, in the adult as well as in the

larval stage. In the younger form (Fig. 7) it is rudimentary, but scarcely more so than in *Mæra* (Fig. 8).

FIG. 6.

Immediately posterior to the point of attachment of this organ with the alimentary canal are a series of muscular bands lying transversely across the latter, which probably fulfil the office of sphincter muscles by compressing the passage just posteriorly to the efferent orifice of this supposed urinary organ. Muscles very similar in appearance are situated near the terminal exit of the alimentary tube, and probably fulfil the office of sphincter muscles to the anal outlet.

The contents of the appendage that we call the urinary organ are, under an object-glass of one-fifth focus, resolved into small round cells, containing a granular nucleus (Fig. 9). These cells are closely packed together,



FIG. 7.

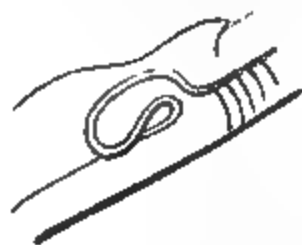


FIG. 8.

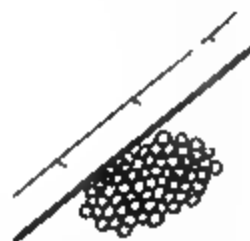


FIG. 9.

but not so as to lose their rounded character, and the whole are confined within stout walls.

CIRCULATION.

The circulatory system in the *Amphipoda* differs very importantly from that of the *Isopoda*. According to some researches of Professor Wagner* on the genus *Porcellio*, there exists a well-developed arterial system in the *Isopoda*. To establish this he adopted the method that was first shown to be practicable by M. Emile Blanchard, and which has since been successfully pursued by M. Kowalewsky on *Idotea*. A mixture of glycerine and water coloured with carmine injected through the heart into the circulatory system, demonstrates the existence of distinct vessels for the passage of the nutritive fluid. The greatest amount of arterial development, as might have been anticipated, is found to exist in the cephalic, branchial, and generative regions, which the author illustrates by diagrammatical figures. In the *Amphipoda*, the heart is situated in the dorsal region of the pereion, reaching from the posterior extremity of the first segment to the posterior of the fifth. It is a long, simple, sack-like vessel, consisting of elastic fibrous walls, possessing more the features of a great arterial vessel than that of a true heart. The blood corpuscles pass posteriorly from the pulsating heart through the entire length of the animal immediately above the alimentary canal, and the great venous course returns along the dorsal surface, probably on each side, until it reaches the last segment of the pereion, where it dips to the ventral surface and enters into the branchial sacs, where it passes down the anterior margin and up the posterior, then direct to the heart, which it enters by three lateral pulsating oblique apertures.

The heart of the *Isopoda* is situated within the dorsal surface of the pleon, except in *Tanais*, and probably

* Ann. des Sc. Nat. p. 37, vol. iv., 1865.

other general of the aberrant type, where it is situated, according to the observations of Fritz Müller, in the dorsal surface of the pereion, corresponding in position with that of the respiratory systems of the various orders.

In the *Amphipoda*, the branchiæ are by no means the simple sacs that they have been described. They are situated upon the inner surface of the coxæ, and assume the form of leaf-like hollow plates, ranged in parallel lines on each side of the sternum (Fig. 10), and are attached to

every pair of legs except the first in the females, and generally the last in males; though, in *Gammarus*, we have seen the seventh pair furnished with branchiæ as well as the preceding. In the *Aberrantia*, the number of sacs is reduced to two or three pairs. In this order they homologize with the branchiæ of the decapod type, each branchial appendage being viewed in the light of a single plate of the compound organs of the higher type; or rather, perhaps, they bear best comparison with the same organ as it appears in the larval condition in the *Brachyura*. The great distinction in their character is derived mostly from the appearance which these organs assume in the higher forms,

FIG. 10.

being that of an internal position. But this is one of appearance only. The branchiæ are overcapped by the monstrous production of the cephalic shield in the Stalk-eyed orders of Crustacea, a circumstance that gives to the portion of the dermal skeleton that it covers the

character and appearance of an internal skeleton. The branchial organs are covered and protected, but they are, nevertheless, essentially external appendages. In the *Amphipoda* this condition does not exist; consequently the branchiæ are pendant in the water, and placed on the inside of the pereopoda, the first joints of which are developed into large squaminiform plates for their more efficient protection.

The internal structure of these organs appears to consist of thick fibrous tissue attached to the inner surface of the wall of each sac (Fig. 11). The fibrous tissue is arranged

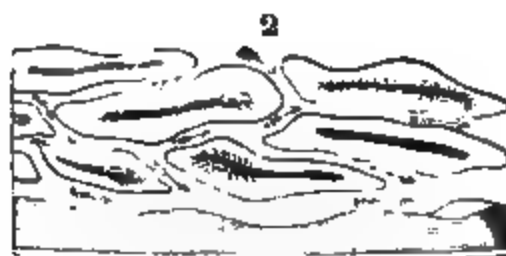


FIG. 11.

in patches of irregular form, but which correspond in their arrangement with one another. These patches are largest near their centre, and thin out towards their margins: the result is that a channel is left between each. All the channels so formed are connected together throughout the entire organ, and exhibit a continuous labyrinth, through which the blood circulates in many small streams.

Should the animal become feeble, a gradual accumulation of corpuscles takes place in different parts of the gills,

mostly at first out of the reach of the stronger currents. As the vitality of the animal diminishes, the arterial current is observed to lessen in force, until it is propelled only by jerks, coexistent with every pulsation of the heart.

RESPIRATION.

The organs of respiration in the *Isopoda* are homologically distinct from those of the *Amphipoda*. We have already stated that Professor Wagner has shown, in the genus *Porcellio*, and M. Kowalewsky in *Idotea*, that the blood in the *Isopoda* runs in arterial channels. We are

FIG. 12.

not aware that any of the *Amphipoda* have been put to the same test as the two genera named in the *Isopoda*; and certainly, to microscopic observation, the structure of the

branchial appendages and other parts of the system that from their transparency and tenuity may be conveniently examined, afford presumptive evidence against the circulation of the blood being confined to walled channels.

In the *Isopoda*, the branchial organs are variously differentiated. In some, as *Ligia*, for example, the passage of the circulating fluid through the branchial plates is clearly and distinctly defined (Fig. 12). The main artery, commencing at the base, gives off numerous lateral branches, that divide and sub-divide into a rich plexus with abundant capillary vessels. In the genus *Sphæroma*, the branchial

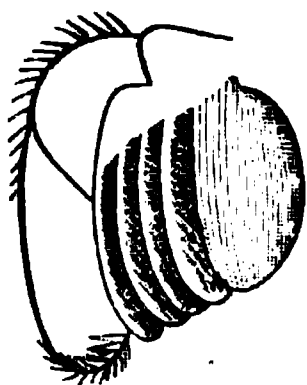


FIG. 13.

organs consist of a series of plates attached to the posterior wall of the fourth and fifth pairs of pleopoda (Fig. 13). In the degraded family of the *Bopyridæ*, the branchial organs are depauperated to the lowest degree, being in some genera little more than excrescences on the ventro-lateral

margins of the pleon.

In *Tanais*, the true branchiæ have not been clearly determined. It is the opinion of Dr. Fritz Müller, Van

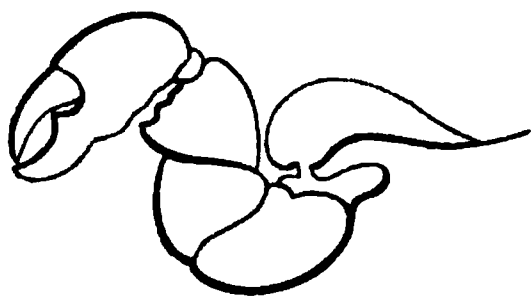


FIG. 14.

Beneden, and Doctor Anton Dohrn, that an appendage attached to the first pair of gnathopoda is not a branchial organ, but a flabelliform appendage, that by its constant

and unvarying motion induces the surrounding medium to flow over the branchial appendages that as yet have not been discerned.

At page 122 of the second volume of this work we have described and figured one of the pereopoda with a sac-like appendage attached, that we considered as the homologue of the branchial sac in the normal *Amphipoda*.

This appendage appears not to be constant in all species, nor in all specimens of the same species. If, therefore, it be the homologue of a branchial sac, it can only be an organ of repetition.

Fritz Müller is quite positive in the assertion that no corpuscles of the circulating fluid pass into the caudal appendages, which are the seat of the branchiæ in the normal *Isopoda*.

The terrestrial *Isopoda* have the respiratory organs somewhat modified from those of the aquatic species. These have been described and figured by MM. Duvernoy, Savigny, Lereboullet, and Professor Wagner. M. Savigny, however, was the first to show that in the genus *Tylos* the system of respiration was carried on by two separate means; the one by branchiæ, as in aquatic Crustacea, the other by the spiracular air-tubes. This has been recently confirmed by Professor Wagner, who shows the relation of the opercular valves to the respiratory system, and contends that, besides their power of protecting the branchial plates from injury, and precluding the too rapid escape of moisture, they fulfil, by means of a plexus of minute vessels, situated at the base of the operculum, a pulmonary function. This organ, which he figures, has, he says, a kind of tracheal division into numerous ramifications. Seen by transmitted light it is opaque, but viewed under a direct light it is silvery white; and he contends that it is a pulmonary or tracheal chamber, which serves as a supplementary organ to the true branchiæ. This view is supported by M. Milne Edwards, as may be seen by the reference to the "Atlas du Règne Animal," (Pl. lxx. fig. l. m.), and "Leçons sur la Physiologie et l'Anatomie comparée," t. ii. p. 141. Our own opinion relative to these organs on the branchial operculum is that they are glands for the secretion of a fluid that

assists in lubricating the branchial plates in warm and strongly evaporating atmospheres. We have been led to this conclusion from finding that they diminish in size in those specimens that have been long detained in dry places

GENERATION.

The organs of generation in the male of the Sessile-eyed Crustacea are not to be determined without great nicety in dissection and care in manipulation. We have, however, in *Sulcator* among the *Amphipoda*, and *Ligia* among the *Isopoda*, been able to examine them clearly, besides less perfectly so in the animals of other genera in both orders. Bruzelius and Loven have given their attention to the former order, and demonstrated the arrangement in the genera *Gammarus* and *Podocerus*. The male organs internally consist of a more or less oblong pair of testes, which are liable to vary somewhat in form in different genera. These testes are fitted with numerous small seminal cells. A narrow passage, or *vas deferens*, connects this organ with a second oval chamber, or *vesicula seminalis*, which is filled with long fine hair-like spermatozoa, lying thickly coiled one upon another. From the *vesicula seminalis* a narrow passage leads to the inner surface of the first joint of the seventh pair of legs, where it penetrates in each into a soft membranous external penis. We have kept species of *Amphipoda* long under observation, and paid close attention to their habits, but have hitherto failed to detect any communication between the sexes which would admit of a direct passage of the penis into the vulva of the female.

The male *Amphidod* grasps the female by one of its strong subcheliform gnathopoda, inserting its claw beneath the anterior edge of the first segment of the

pereion, whilst another is inserted beneath the posterior margin of the fourth or fifth segment. Grasping the female in this way, the male draws it into immediate contact with itself, so that the dorsal surface of the female presses against the ventral surface of the male. In this attitude, more or less firmly compressed, they swim about or rest on any convenient surface for many days. If the two be driven asunder through fear of any danger, the female seeks a place of shelter, while the male swims more actively about. Should the male swim within some little distance of its late companion, it becomes immediately aware of the circumstance; and we have seen it, after having passed the spot, abruptly turn back, seek her out, and seize her with avidity from amidst a numerous mass of others. Immediately after securing, he strikes her with two or three strong lashes of his tail. The female, rolling herself closely up, is carried off by her more powerful mate.

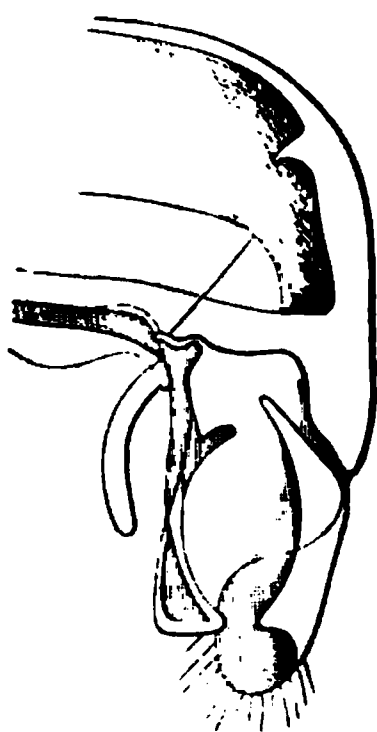


FIG. 15.

This contact between the two sexes is either occasionally repeated, or it may last throughout the entire period of incubation. We have frequently taken them so coupled, even when the young have been so far developed as to be enabled to leave the care of the parent. We are induced, from this fact, to believe that a series of broods may take place successively through the year, and that the erotic state of the female may exist during the period of incubation.

The penis (Fig. 15) is a soft membranous tube, that terminates in a small orifice. It probably has, under certain conditions, the power of becoming harder, but

it generally lies pendant from the inner side of the coxa, and is longer in some species than in others. In the genera *Proto* and *Caprella*, the penis seems to be formed out of the anterior pairs of pleopoda, just as is the case in the *Brachyura*, among the Stalk-eyed Crustacea. These observations are further confirmed by those of M. Rousel de Vauzeme on the genus *Cyamus*.

In the *Isopoda*, these organs have been carefully worked out by Siebold, Lereboullet, and Schöbl. In the genus *Ligia* (Fig. 16), we have observed on each side three testes,



FIG. 16.

consisting of long narrow vesicles, thinning away to exquisitely fine filamentary prolongations. These vesicles increase in diameter as they approach towards the efferent duct, where they rapidly become constricted before uniting with the *vas deferens*. These vesicles are filled with seminal cells, and are, we believe, the true testes. M. Lereboullet, however, in his researches on the *Oniscida*,* states that he has observed that each of these fusiform sacs has

attached to its extremity other irregular sacs, which he regards as the principal secreting organs, and consequently the spermogenic glands or testicles. These

* Mém. sur les Crustacés de la Famille des Cloportides, par A. Lereboullet. Strasbourg, 1852.

organs, which have previously escaped the observation of anatomists, the author says, "are very irregular sacs, variable in form, simple or compound; they are generally about three-quarters of a millimetre in length, but sometimes less. They are situated deeply on each side the stomach, and are retained in their position by delicate but strong ligaments, which are covered with black pigment, which lose themselves between the muscular fasciæ of the segments of the body. These organs are full of cells, that M. Lereboullet considers as the spermatic cellules. The second vesicles, or those which we thought to be the true testes, M. Lereboullet calls *testicules accessoires*. They are, he says, three in number on each, enlarged towards the middle; they thin out insensibly towards the extremities: at one end they unite with the organs that M. Lereboullet calls the testes, and at the other they open into the spermatic reservoir—the *vesicula seminalis*. These accessory testes contain cells which are of two kinds, the larger being less numerous than the others. From these vesicles an efferent duct leads to the *vesicula seminalis*, which in *Ligia* is a long and narrow vessel, increasing in breadth gradually as it approaches its extremity, where it is suddenly constricted to a narrow outlet, which, covered with black pigment cells, leads direct to the external penis, which is situated near the centre of the ventral arch of the seventh segment of the pereion. In the males, processes of the branchial appendages are developed into stylets, (*vide fig. 12*), that we suppose must have some secondary influence in the process of fertilization.

The anatomy of the reproductive organs in the females has been carefully worked out by MM. Loven and Bruzelius in the *Amphipoda*, and by Lereboullet and Schöbl in the *Isopoda*.

According to the former authors, corroborated in part by Mr. H. Goodsir on the genus *Caprella*, by Roussel de Vauzeme on *Cyamus*, and from our own direct observation on *Gammarus*, &c., the internal organs consist of two sets of ovaries. These are long cylindrical bodies, having a duct near the middle, on the inner side, that opens into the vulva, which is situated on the inner side of the coxa of the third pair of pereopoda, or fifth pair of legs. According to the latter authors, the structure of the same organs in the *Isopoda* is very similar; but M. Lereboullet has failed to trace the connection of the ovaries with the vulva. Herr Schöbl has been more successful in his researches on the genus *Typhloniscus*, and has figured them attached to the inner surface of the fifth pair of legs. He has also described and figured a pair of *receptaculæ seminales*, in which the male animal deposits the spermatozoa that fructifies the ovæ. According to this statement, in the *Isopoda*, if not in the *Amphipoda* also, the male impregnates the female by direct intromission—a circumstance of which we have entertained some doubt, partly arising from the formation of the animals themselves, particularly of the *Amphipoda*, in which the development of the coxæ and the narrowness of the animal would almost, it would seem, preclude the possibility of the sternal portions of the animals being brought into immediate contiguity, and also from the circumstance of having watched the animals, particularly *Asellus*, from previous to impregnation to the birth of the young, we have never seen the male in any position relative to the female except in that previously described.

The incubatory pouch, in which the ova are deposited, from the period of their fertilization until the young are developed sufficiently for independent existence, is the result of the folding over of several lamelliform plates,

generally fringed with hairs. One of these plates is developed on the inner side of each of the two pairs of gnathopoda (Fig. 17), and the two anterior pairs of pereopoda. These plates overlies each other in a compact form, securely protecting the ova, or the immature young, from external accidents, as shown in fig. 10, p. xxxiii.

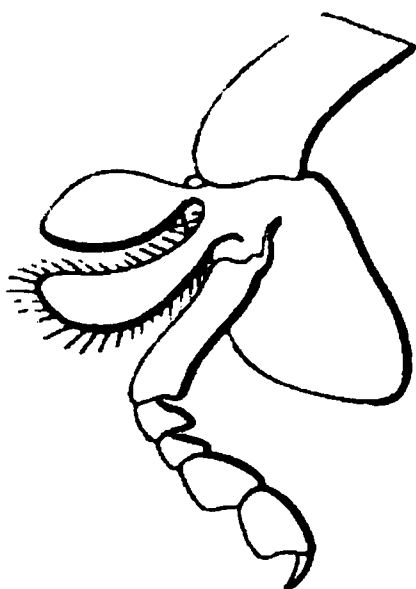


FIG. 17.

It is the opinion of Von Siebold that these appendages are periodically developed at the "époque du rut."

This we have not, from our own observation, been able to verify, having taken females during all periods of the year with these appendages fully developed. They are absent on the young females. We believe, however, that, when they are once developed, they continue permanent organs, only disappearing as the result of accident.

In the *Anceidæ*, the incubatory pouch appears to belong to the three posterior segments of the pereion. By the continued growth of the ova, the pereion is reduced to a most impoverished state. The alimentary canal being in a collapsed condition, and always empty, the animal can only be viewed in the light of a great egg-producer, after the development of which an empty sac only is left, the poor remains of a worn-out animal.

The history of the development of the ovum from its impregnation to the development of the perfect larva has been best worked out by Valette St. George in the *Amphipoda*, and Anton Dohrn in the *Isopoda*. We must refer the student to the memoirs of these two authors for a detailed account of the germination and growth of the ovum in all its stages. It will suffice for us to say, that it appears to be clearly established by

all observers, that in the progressive growth of the ovum, the embryo of the *Amphipoda* is rolled within the egg in an opposite manner from that of the *Isopoda*. The latter is folded backwards, so that the ventral appendages are developed on the external surface, whereas the *Amphipoda* is bent on itself, the ventral appendages being developed on the inner surface. Dr. Fritz Müller states that, in *Tanais*, one of our aberrant genera, the development of the larva is after the manner of the *Amphipoda*, and not of the *Isopoda*, among which it is classified.

The length of time between the epoch of the deposition of the ovum in the incubatory pouch, and the period of the emancipation of the young animal from the care of the parent, is probably about six weeks. We have observed that to be the time required in the genus *Asellus*.

At first the egg is perfectly round. It shortly afterwards increases in one direction, becoming also somewhat larger in *Amphipoda* at one extremity. Indistinct segments are now observable. The wall of the ovum is of an elastic character, and yields to the movement of the internal embryo.

Probably about the middle of the period of incubation the embryo quits the egg, for we have constantly taken it from the pouch in a very immature condition, without being enclosed in the egg-case. The larva at this period is very immature, and enclosed within a general tunic, which, without having any apparent vital connection with the animal more than the original egg-case had, adapts itself in general form to the whole creature, and fulfils the duty of a protective tissue. As the embryo increases in dimensions and completeness of form, so the tunic corresponds in size and form. At length, freeing itself from this case, the larva strengthens in its own development, but does not immediately quit the care of the parent.

We have frequently observed the young *Talitrus* escape from the mother, upon the capture of the latter; and from the active state of their existence at this time, they appear as if they had long been capable of so acting, if they had required it. The observation of Dr. Salter on the common *Gammarus*, detailed at page 380 of the first volume of this work, fully confirm this fact—as does the circumstance that the young of *Arcturus* are protected by the mother, who supports and carries them about on the antennæ. Also we have been able to corroborate the observation of Mr. H. Goodsir, that the *Caprella* carries about its young attached to its body. These, together with the fact that many genera, particularly of the *Podoceridæ*, protect and nurse their young for some time within nests, which they build apparently for no other purpose, afford abundant proof that in these animals there is a conscious love of offspring that appears to be less marked in animals far higher in the scale of scientific classification.

When the young of *Gammarus* first swims about as a free animal, it only resembles the parent in a modified degree. The antennæ show no distinction between the peduncle and the flagellum. The latter is shorter, and consists of but five articuli, while thirty to forty may be present in the parent. This relative proportion is visible also in the lower antennæ, and in the secondary appendage of the upper, which increases with advancing age, until the adult stage is acquired.

In the structure of the eye we see the same gradual increase going on after the animal has become free. The lenses in the young are from ten to twelve in number, whereas, in the adult, from sixty to eighty may be counted. In many genera it also changes its colour, as does also that of the animal itself.

The young are generally white, or of a deep orange colour; in the adult, the colours vary apparently in relation to the presence of light and other surrounding circumstances. Occasionally the males vary in colour from the females. We see in *Orchestia* a rosy tint frequently ornamenting the great claw, and some other parts. We have also observed in *Amphithoë littorea* the well-matured males assume a yellowish appearance. This may also be the case in other genera of which we have not had the opportunity of exact observation.

In *Orchestia*, the second hand in the larva bears a near resemblance in form to the same appendage in the female—a fact that is, we believe, consistent throughout the entire class. The warty development of one of the posterior legs also increases with age.

In *Hyperia*, the larva bears but little resemblance to the parent. This was first pointed out by M. Milne Edwards, and next by Mr. Gosse. But more extended observations of the forms of these young animals were detailed by us in a memoir published in the “Annals of Natural History for 1861,” on some exotic species. Our observations on the larvæ of the parasitic *Isopods* show a wonderful similarity between the larvæ of families in distantly separated orders.

NERVOUS SYSTEM.

The nervous system was first made out in a general memoir on the subject by MM. Milne Edwards and Audouin. The observations of these authors have since been generally verified by HH. Loven and Bruzelius in the *Amphipoda*, and Lereboullet in the terrestrial *Isopoda*. We have also carefully dissected out most of the system in both the genera *Talitrus* among the *Amphipoda*, and *Ligia* among the *Isopoda*. The plan of the nervous

system in these two orders is that of a typical crustacean. A ganglion corresponds to every segment of the animal; those belonging to the organs purely of sensation being amalgamated together into a cephalic lobe. This is very beautifully shown by HH. Loven and Bruzelius (*Bidrag till Kännedomen om Amphipodernas inre byggnad* *).

Every ganglion of the several segments after the head is united to the others by two parallel cords in the *Amphipoda*, and one in the *Isopoda*, although in the genus *Ligia* we distinctly made out two, as in the *Amphipoda*: from each ganglion, on the right and left, is given off two main branches, and in *Ligia* we observed two other less important threads. These supply the legs and internal viscera. From the cords, about midway between each ganglion, branches off, on the external side of each, a single branch, which in the *Oniscidae* M. Lereboullet places nearer to the preceding ganglion. In the *Amphipoda*, we found it rather nearer to the succeeding ganglion. In *Ligia*, it appears to be just midway between the two, from the base of which, both before and behind, spring other thread-like branches.

The diagrams of the arrangement of the caudal supply of nerves, given in the memoir of Lereboullet, differ from that given by M. Milne Edwards in his "*Histoire des Crustacés*." The latter author figures a distinct ganglion to each of the caudal segments, illustrating his view from observations on *Cymothoë*, in which the six segments are separate, while Lereboullet illustrates the caudal ganglia as being consolidated into a single mass, from which numerous threads are sent back to the extremity of the animal. Moreover, this author only figures six separate ganglia after the cephalic mass, which would make (even allowing the oral appendages to be supplied with small filaments of nerves, instead of branches springing from

[* *Ofversigt af Kongl. Vetenskaps-Akademiens Förhandlingar*, Jan. 1859.

a well-developed ganglion), the seventh segment of the pereon to have its ganglion consolidated with those that supply the caudal region—a view that our own observations lead us to believe has been founded on a misconception.

GEOGRAPHICAL DISTRIBUTION.

The *Geographical Distribution* of the two orders of the Sessile-eyed Crustacea, if made under careful and extensive observations, would (from the great amount of the modification of parts, while a close assimilation of general form is very persistent throughout great numbers of genera) afford one of the most interesting and, we believe, instructive chapters in the distribution of life over the globe.

The subject has not yet sufficiently been worked out so as to approximate to correct information; for so much of the earth's surface has yet to be searched, that it is by no means improbable that new and intermediate forms may frequently be found in places that are yet unknown, so that forms that as yet are described as species or genera may be only modified forms of one species, or, as has been demonstrated by M. Hesse with respect to *Anceus* and *Praniza*, that animals placed by authors in separate genera and in distinct families may be only sexually distinct.

Such imperfect information as is at our command, while it does not enable us to grasp the subject so as to do justice to it as a whole, has yet enabled us to observe some points of interest that our British species possess in relation to exotic forms.

With the exception of a single specimen, brought from Algiers by M. Lucas, the genus *Talitrus* is only known as an inhabitant of the northern and western coasts of Europe, while its closely allied form, *Orchestia*, and its congeners, excepting *Nicea*, of which we know but one or two species (which tend to corroborate the assertion), appears to be

very abundantly scattered over the whole world. Like *Talitrus*, *Orchestia* lives out of the sea, choosing moist places, but not burrowing a habitat for itself as *Talitrus* does. With us, *Orchestia* lives within the reach of the spray of the sea; but some species in the Southern Hemisphere live many miles inland, choosing terrestrial plants for their abode, sometimes at an elevation of fifteen hundred feet above the level of the sea. In these specimens the males, and, we believe, the males only, have some one or other of the joints of one of the posterior pairs of legs developed into a large internally concave scale, which, we believe, assists in retaining moisture, so that the branchial sacs may not suffer from desiccation.

The genus *Montagua* appears to be wholly confined to the northern temperate latitudes, the species gradually diminishing in size as they approach the warmer seas. The close assimilation of this with *Stegocephalus* and *Pleustes* of the colder latitudes, is shown by the interchange of certain parts in their structure. In *Montagua*, the superior antennæ have no secondary appendage, neither have the mandibles a palpiform one, and the posterior pair of pleopoda terminate in a single ramus. *Pleustes* resembles *Montagua* in the former characteristics, but has the posterior pair of pleopoda terminating in two rami. *Stegocephalus* resembles *Pleustes* in its characteristics, but it has a rudimentary appendage on the superior antennæ. We have little doubt but that the others have also such an appendage in the larval condition, since it is a common feature in young *Amphipoda*. *Stenothoë*, in the Southern Hemisphere, represents the *Stegocephalidæ* in the Northern, and agrees with *Montagua* in all important characters; it differs in having a very large hand to the second pair of gnathopoda,—a doubtful generic character, in our estimation.

The genera of the sub-family *LYSIANASSINA* appear to be very generally diffused over the entire globe, increasing in dimensions in those species that approach nearer to the Arctic and Antarctic latitudes, in some instances reaching to the largest known of the order, equalling three inches in length, as may be seen in *Lysianassa Magellanica*, from the Straits of Magellan, and *L. gryllus*, from Spitzbergen. These two so closely resemble one another, that they cannot be characteristically distinguished.

The genus *Ampelisca*, and its near ally *Haploops*, we only know as belonging to the Northern Hemisphere, but in that region extending from Japan to Europe, from Greenland to North Carolina on the coast of America, and in Europe to the Mediterranean Sea.

In the sub-family *PHOXINA* all the genera but one are only known in the north temperate region, but with a widely diffused area, extending from Japan to Europe. One species of the genus *Cediceros* has been taken in New Zealand, and one of *Iphimedia* in Terra del Fuego. Of the former we have our doubts in its relation to the genus; the latter has a very near resemblance to *I. Eblanæ* of Europe. Most of the genera of this sub-family are burrowers in mud or sand. *Isæa* dwells, without being parasitic, on the back of hairy crabs, and the only specimens of *Darwinia*, that have been taken alive, were found adhering to the throat of a cod-fish. The genus *Sulcator* lives on sandy shores, making tracts along the margin of the sea, somewhat similar to those found in older slate and sandy rocks; and it may be interesting to remember that we have attributed to this sub-family the only *Amphipod* that has been hitherto discovered as fossil, the *Prosoponiscus problematicus* of the magnesian limestone of Durham, and Zechstein-dolomite of Glücksbrun.

The family of GAMMARIDÆ belongs to the Arctic and north temperate zones. With but few exceptions of the closely allied congeners *Dexamine* and *Atylus*, which consist together of twenty-one species, we know of only one taken, near Valparaiso: all the rest are northern species. Of the genus *Aora* but two species are known; one from the British seas, the other from the western coast of South America (Valparaiso). Judging from the figures in Gay's "Hist. de Chile," the resemblance of the two species is remarkably close, an apparently useless tooth on the anterior margin of the first pair of legs of the southern form alone distinguishing it from the northern.

The subterranean fresh-water genus *Niphargus*, which lives generally in closed pump-wells in England and many parts of Europe, has its nearest congener in *Eriopus*, from the deep sea off Bohusia. Judging by the figure given by Bruzelius, there is little that distinguishes one genus from the other; and it is highly probable that *Gammarus pungens*, from the warm springs of Italy, is also a species of *Niphargus*. Of the two species of *Cran-gonyx*, another fresh-water subterranean genus, one is found in England, the other in Kamschatka, and these bear a very close resemblance to the female form of the marine *Gammarella*, a genus, though only having three species, found in the European seas, as well as on the South American coast and at Pitt's Island. Species of the genus *Melita* have been taken in European, Brazilian, and Indian seas, and *Mæra* extends all over the temperate zones of both Northern and Southern Hemispheres. The genus *Amathia* is essentially an Arctic form, the species losing their size and spinose character as they approach the temperate seas. No species has been recorded south of the English Channel, while a species found on the Crimean

shores of the Black Sea is as large and well developed as the Arctic specimens. From Pondicherry, also, a specimen is recorded that closely resembles the large specimens of the northern type.

The genus *Gammarus*, even as we have restricted it, contains between forty and fifty species, all of which are Arctic and north temperate, and extends round the globe, except one taken at Jamaica, another at New Holland. Fresh-water species of the genus inhabit the rivers and streams of Europe and North America. *Megamaera*, a near congener of *Gammarus*, has the largest and most spinose species in the northern regions, while others are found at Peru, Borneo, and the Zooloo seas.

The genus *Amphitoë* contains between thirty and forty species, and is very universally spread over the globe, species having been taken in the Arctic seas and all round the coast of Europe, in the Black Sea, and the Mediterranean; they have been found at the Cape of Good Hope, and on the eastern and western coasts of South America, on the Australian shores, as well as in Zooloo and Japanese seas, in the islands of the Pacific and Atlantic Oceans, also on the weed in the Saragossa Sea, of the Atlantic, and on floating plants in the Pacific; and one species is recorded from the fresh-water marshes of South Carolina.

Podocerus is mostly northern, extending, however, down the coasts of Europe and America. One species is recorded by Dana from the Bay of Sunda, and another from the shores of Brazil.

Cerapus, including its female, *Leucothoë*, has a wide range, species having been taken on the European and North American shores, on the eastern coast of South America, and in the Indian and Zooloo seas, while its near ally, *Siphonacetus*, has only been found on the north-

western shores of Europe. The genus *Nænia*, all the species of which are closely allied in form, has only been recorded from the British shores. Four species of *Cyrtophium* have been discovered, one of which is from the East Indies, one from Rio Janeiro, and two from the north-west of Europe. *Corophium*, so abundant when found, has been taken on the western shores of Europe, the Mediterranean, on the coasts of Japan and Brazil. It burrows in mud; but there is reason to doubt either that it preys on the Annelids or migrates at particular seasons.

That terrible wood-destroyer, *Chelura*, so devastating to the piles and submarine timber all round the shores of Europe, has not been recorded from other lands.

We have generally looked upon the *Hyperina* as pelagic species; but recently it has been pointed out by Mr. Edward, that some of our British genera burrow into and hide themselves in sand on the shores of the Moray Firth. The two British species of *Hyperia* (which we have great reason to believe to be but one, being male and female), have an extensive geographical range, from Greenland to Cape Horn, from Rio to the Zooloo seas.

Vibilia has apparently an equally extensive range, though fewer species have been determined. *Themisto*, also, has been recorded from Greenland to sixty-three degrees south latitude in the Atlantic Ocean, while species of *Phronima* have been taken as far north as the Shetlands, as well as in the Atlantic, at Naples, and at Borneo. The *Caprellidæ* appear to be very universally and abundantly diffused. The very close resemblance of the species from very distant and opposite localities is suggestive of a close affinity in the respective forms. Specimens from Japan, and the eastern coast of North America, are not appreciably distinct from others found on the eastern coast of South America, as well as on our English coast; and when we take into consideration the

changes in the forms that the animals of this genus undergo in their growth to an adult state, it is not improbable that immature specimens may be misinterpreted for adult varieties. *Cyamus* lives parasitically on the whale, and probably thrives on no other animal. The one or two solitary specimens that have been found attached to the dolphin are probably young creatures that have strayed from their natural habitat.

The genera of *Isopoda* appear to be more generally diffused throughout the various regions of the sea; and from the various distant localities in which that species have been found, some may be inclined to think that they are universally distributed.

The genus *Tanais* has been found on the coasts of North-Western Europe, Brazil, in the Zooloo and Feejee seas, as well as on the western coast of North America; and equally varied have been the recorded habitats of the nearly allied genera, *Paratanais* and *Leptochelia*, which latter Fritz Müller believes to be the male of *Tanais*. The near ally, *Apseudes*, is only known in Europe and Egypt, where but few specimens of two closely resembling species have been found. The genera *Anthura* and *Paranthura* are also sparsely represented, both in the species and specimens. They have been taken on the southern and western coasts of Europe, at New Zealand, the Mauritius, and the Cape of Good Hope, as well as on the eastern coast of North America. Of the genus *Anceus*, of which eleven species have been determined on the north-west coast of France, by M. Hesse, three at most are known to the rest of Europe, and but a single species to the eastern coast of North America.

The *Bopyridæ* are tolerably abundant in the temperate regions, but few in the more tropical or Arctic latitudes, the genera confining themselves with considerable exactitude to peculiar species of Crustacea. Thus we have failed

to detect *Cryptothiria*, which we have found to be tolerably abundant in the genus *Balanus*, in *Cthamalus*, whose habits and general appearance are so closely allied to it.

The several genera of the family *Ægidae* are animals peculiarly belonging to the temperate seas, and adequately represent the *Cymothoidæ* of the torrid zone. It is remarkable that, being parasitic upon fishes, no species of the latter family has been hitherto detected on our own coasts.

The *Asellidæ* flourish chiefly in the temperate regions of the seas, being scarcely represented in the frigid zones, and not at all in the torrid.

Arcturus is peculiarly an *Isopod* of the colder zones, where its species grow to the greatest dimensions in both the northern and southern seas; but a single specimen has been taken in the torrid zone, in thirty-one fathoms of water, north of Borneo. The *Idoteidæ* flourish everywhere, the largest specimens being in the Baltic Sea and near Cape Horn. They live amongst the weed, either fixed or floating, and species have been often taken swimming free in mid-ocean, where they assume, as Crustacea under the same condition frequently do, a deep indigo-blue colour. The *Sphæromidæ* are a family that are very littoral in their habits; they range from the equatorial latitudes to the colder regions of the temperate zones, but die out before reaching the Arctic and Antarctic isothermal lines. In hotter latitudes, some species, in their depredations on submarine timber, take the place of *Limnoria*, a genus of the *Asellidæ*, and surpass it in the extent of their capability of injuring submerged wood.

Ligia, and the other terrestrial genera, appear to find their home best in the temperate latitudes, but live from the equator to within a short distance of the frigid climate.

These few observations, imperfect as they naturally

must be, demonstrate, we think, the great amount of interesting information that a more complete study of the subject must elucidate. (C. S. B.)

As the information conveyed in the following letter reached us too late to appear in the Appendix, we think it but just to the author to publish it entire; the more so since, during the progress of his researches, we repeated them and know their accuracy.

MY DEAR SPENCE BATE,

You are kind enough to ask me for a short abstract of my investigations in the anatomy of Anceidæ which I tried to make when staying with you in Plymouth. I am the more glad to follow your request, since it is especially your Memoir upon these animals that made me desirous to work on them. You were quite right in directing the attention of observers to the internal structure of these little Crustacea, for there are some points in their organization which were not followed up by Mr. Hesse in his elaborate Memoir, and some points in which, your opinion differing from that of the French naturalist, we had no certainty about their real nature.

I do not think that you are right in speaking of an early distinction between the male and female Anceus. There is no doubt that the outward aspect of some of the little Pranizæ, just having left the parent, makes more the impression that they are to become Anceus, whilst others resemble more the female, or Praniza form. But in giving special attention to that point, I found that this impression was only due to the expansion of the segments of the pereion being greater or smaller than to any real difference. Besides that, I kept some animals, which had rather the aspect of females than males, during some time in a glass, and had the opportunity of watching their moult. Two of them enabled me to see the large projecting mandibles of the males within the head of what I thought was a female. I examined immediately the sexual parts of the specimen, and found a well-developed penis on the last exceedingly small segment of the pereion. There can be no doubt, therefore, that Praniza changes into Anceus.*

This is what Mr. Hesse contended. But though I must agree with him in this, I cannot but have another interpretation regarding the so-called larval or Praniza state. Mr. Hesse says, that only the Anceus state is the adult state, and that, "quelques jours avant la transformation des Pranizes féelles en Ancées les œufs qui préexistent s'aperçoivent à travers la peau," &c. In calling the eggs pre-existent, he is not, it appears to me, justified, for they make their appearance very soon, and begin their development in animals which are far from the Anceus period, which Mr. Hesse calls their Anceus state. I agree, on the contrary, fully with you in calling the adult or Anceus state one of a retrograde character, for every organ begins then to degenerate.

Regarding the digestive apparatus, my investigations have led me to other results than your remarks seem to show. I could observe the mouth and the whole intestine in the old males as well as females. Those sacs, filled with green mass, are the liver sacs, as the study of their embryology clearly states. The embryology clearly indicates the Isopodous nature of the family; but I must say that I never found, nor expected to find, such forms as Mr. Hesse figures with a central red eye. There certainly must be an error in his drawings.

There is another puzzling circumstance regarding the conformation of the segments. In the adult there seems to be the want of one of the typical segments, and you consider it to be either the first or second segment of the pereion. But my embryological investigations show that all the typical segments are present, as in other Isopoda. In the very early state of the embryo you will find two pairs of antennæ, one pair of mandibles, two pairs of maxillæ, and seven pairs of feet. Every one of these extremities corresponds with a segmental division of the body. But there is between the last pair of the pereopoda and the first pair of pleopoda a segment whose extremities are wanting. This segment afterwards constitutes a very small portion of the pereion, and is rather easy to be overlooked; in the male the penis is fastened to it. Counting that segment, you will find there is none wanting in the composition of the body; and you can be quite sure in calling the first pair of the legs of the embryo the maxilliped, and the second the gnathopod, for both are connected with the mouth in a very early state already.

I could add some more particulars about the internal structure of the animal, but it would hardly be of much use without adding plates to what I have to say. What I have already stated will, however, show, that though there are some anomalies about the Anceidæ, they are not of such extent as formerly was believed. I hope, besides, to give a complete account of my investigations in a short time in one of our German periodicals.

Yours &c.,

Messina, October, 1868.

ANTON DOHRN.

* It must not be forgotten, with reference to this too general expression, that it is only the male individuals (having in the young state the form of Praniza) which are transformed into the Anceus state; the females retaining their preceding form of Praniza. I. O. W.

BRITISH SESSILE-EYED CRUSTACEA.

Order—AMPHIPODA.

Group—NORMALIA.

Division—HYPERINA.

IN this DIVISION the eyes are generally developed to an abnormal size, often nearly occupying the whole surface of the head. The antennæ are frequently absent, or, when present, more or less abnormal in their form, rarely ending in a multiarticulate flagellum. The appendages of the mouth are rudimentary or obsolete. The arms are small and less powerful than the walking legs, varying in different families from the simple to the complexly-chelate form. The body has the segments generally separate, although in some genera, as *Phrosina*, of which we have no British example recorded, the first two are fused together. The tail also has the segments usually distinct, but in some exotic genera, as *Pronoë*, *Brachyscelus*, &c., the fifth and sixth segments are incorporated into one. The appendages are more liable to aberration than in the *Gammaridæ*. The animals are remarkable for the paucity of hairs that exist upon their integumentary tissues, and are, for the most part, parasitic in their habits, attaching themselves to fishes or medusæ; they are able, however, to swim with ease.

This division is synonymous with Milne Edwards's family of *HYPERINES*, and also with Dana's family of *HYPERIDEA*. It contains four families, two only of which have representatives in our British Fauna, namely, *HYPERIIDÆ* and *PHRONIMIDÆ*.

Fam. I.—*HYPERIIDÆ*.

The head is large and globular, being nearly occupied by the eyes. The superior antennæ consist of a three-jointed peduncle and a flagellum, variable in length, but of which the first articulus is very long. The inferior antennæ are formed of a peduncle and a variable flagellum. The first two pairs of legs are simple, but have the wrists more or less infero-anteriorly produced; the other legs are generally subequal in size. The three anterior pairs of swimming legs resemble those of *Gammarus*, but the three posterior are broad, flat, and biramose; the rami being lanceolate, and frequently serrated, but destitute of any ciliary fringe.

The species are oceanic in their habits, and found to exist only in the gill cavities of the medusæ.

AMPHIPODA.
HYPERINA.

HYPERIIDÆ.

Genus—LESTRIGONUS. (*Edwards.*)

Lestrignonus. MILNE EDWARDS, Ann. des Sci. Nat. xx. p. 392. Hist. des Crust. iii. p. 81. DANA, U.S. Explor. Exped. p. 982. SPENCE BATE, Cat. Amph. Brit. Mus. p. 287.

Generic character. Cephalon orbicular, deeper than broad. Segments of the pereion short, three times as deep as long. Pleon longer than the pereion; first three segments long and the three posterior short. Eyes large, occupying the entire lateral walls of the cephalon. Antennæ long, subequal, terminating in multiarticulate flagella. Mandibles having a triarticulate appendage. Gnathopoda complexly subchelate. Telson single, squamiform, triangular.

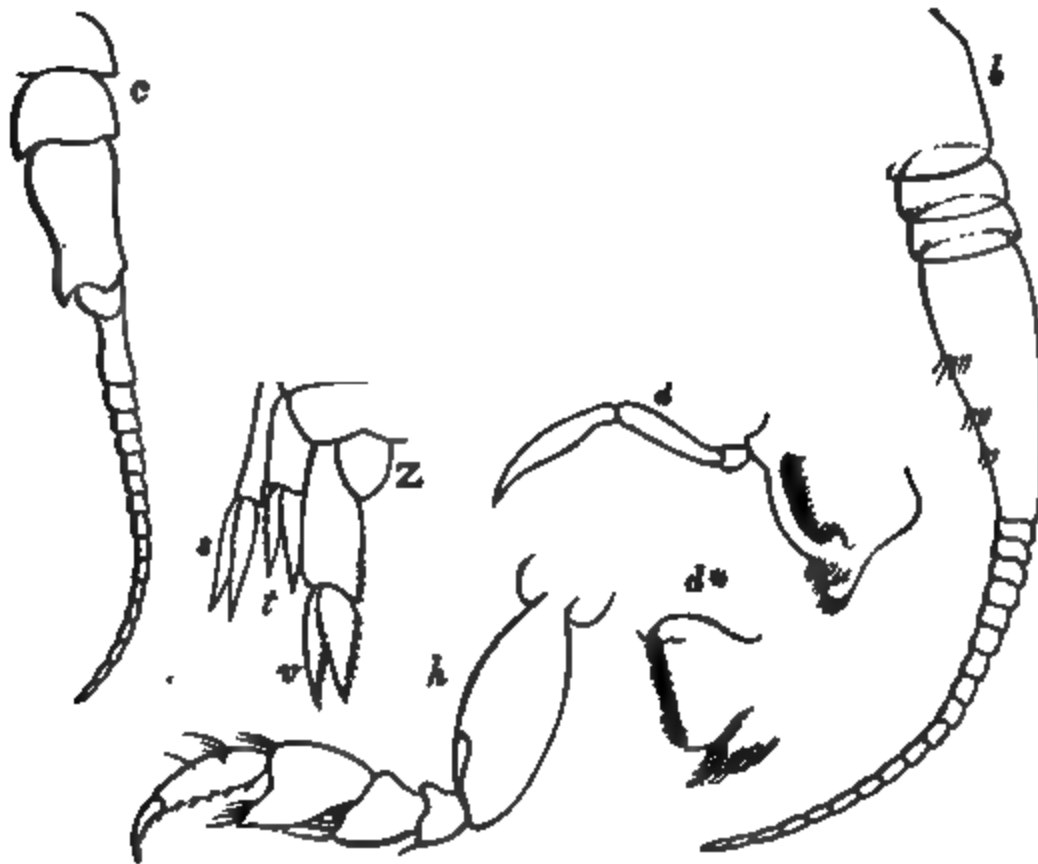
THE head is large and rounded. The segments of the body are short, while those of the tail are much longer, the three anterior being the longest. The eyes are very large and occupy the whole of the lateral walls of the head, meeting nearly at the top and considerably encroaching upon the facial surface. The antennæ are of the same length, and are generally very long, never being shorter than the depth of the head and always terminating in a multiarticulate flagellum, the first articulus of which is very long, apparently consisting of several articuli fused together. The mandibles are furnished with a three-jointed appendage. The first two pairs of legs have the wrists infero-anteriorly produced to a sharp angle; the hand is narrow and the finger short and sharp, which, being capable of closing against the produced point of the wrist, forms with it a completely subchelate organ, very characteristic of the

whole of this division of *Amphipod Crustacea*. The walking legs are nearly of similar length, but have the coxæ, especially of the two anterior pairs, not so deep as in the *Gammarina*, and the thighs less broadly developed. The natatory appendages possess no conspicuous distinction from other *Amphipoda*, but the three caudal pairs have the peduncles broad and flat, and the rami sharp and triangular. The middle piece is small, triangular, and squamiform.

The geographical distribution of this genus appears to be world-wide, since it has been observed in the Atlantic as well as the Indian and Pacific Oceans, from the arctic to the tropical latitudes.

AMPHIPODA.
HYPERINA.

HYPERIIDÆ.



LESTRIGONUS EXULANS.

Specific character. Antennae reaching only to the third or fourth segment of the pereon; inferior pair having the last joint of the peduncle terminating inferiorly in a small tooth or point. Propodes of each pair of gnathopoda serrated.

Lestrigonus exulans. KÄRSTEN, Grönl. Amph. p. 68, pl. iv. f. 18, a, b, c.
EDWARDS, Hist. des Crust. t. iii. p. 82. BRANCH
BARN, Cat. Amph. Brit. Mus. p. 287, pl. xviii.
fig. 2.

THE head is oval, the vertical being the longer axis. The eyes are large, and occupy the entire lateral walls of the head. The antennae are nearly of equal length, and reach to about the third or fourth segment of the body. The superior pair are rather longer than the inferior, and have the first articulus of the flagellum longer than the

peduncle; the remainder being very short, the basal ones being shorter than broad. The inferior pair have the last joint of the peduncle nearly as wide at the distal extremity as at the base, and terminating inferiorly in a strong tooth. The flagellum is suddenly narrower, and after the first articulus consists of several short articuli. The mandibles are broad and short, not terminating in teeth, or a sharp cutting blade. The molar denticle consists of a flat plate, furnished with a thick down of hair. The appendage has three joints; the first extremely short, the others being equal, and the last terminating in a sharp point; the whole being remarkably free from hairs. The first two pairs of legs are very small and sub-equal; the first pair have the metacarpal joint and wrist inferiorly produced, and tipped with several stiff spines. The hand is narrow and tapering; the inferior margin serrated, the serrature consisting of a series of rather long teeth, associated in groups of three, the longest in each group being the most anterior. The finger is slightly curved, and armed upon the inner margin with a serrature similar in character, but less regular in feature, to that of the preceding joint. The second pair of legs much resemble the first, but have the wrist rather more infero-anteriorly produced. The hand is a little longer, and has the armature upon the inferior margin, as well as that of the finger, less distinctly marked. The other legs are nearly of equal length. The caudal appendages vary in length; the penultimate pair being considerably the shortest, while the last are the broadest and longest, and have the inner ramus, as well as the inner margin of the outer ramus, freely serrated. The middle tail-piece is ovately lanceolate.

The antennæ in our British specimens are slightly longer than represented in Krøyer's figure of the type.

We also observe that the peduncle of the second pair of antennæ is not so decidedly truncate as in ours ; but, in spite of these differences, which are probably due to the delineator, we believe that our British form is identical with that of Kröyer's arctic specimen.

The original specimen was taken by Kröyer in Greenland. British specimens have been sent to us from Carrickfergus, where they were found by Professor Kinahan, to whom we are indebted for the first British specimen ; from Cumbræ, where they were obtained by Mr. Robertson ; and they have been recently sent to us from Banff, where they were taken by Mr. Edward.

The resemblance between this species and *L. Gaudichaudii* from Chili is very close, but the two species can be readily distinguished by the character of the armature on the hands of the first two pairs of legs.

AMPHIPODA.
HYPERINA.

HYPERIIDÆ.

§

LESTRIGONUS KINAHANI.

Specific character. Antennæ subequal; the superior being rather the longer, equally the entire length of the animal.

Length $\frac{1}{4}$ inch.

Lestrigonus Kinahani. SPENCER BATE, Cat. Amph. Brit. Mus. p. 289, pl. xlviii. fig. 4.

THE resemblance between this species and *Lestrigonus exulans* is remarkably close; so much so, that should the animals of either species lose their antennæ, we believe that the most acute observation would not be able to detect any distinguishing feature.

The antennæ are rather longer than the animal, being nearly of equal length; the upper are, however, somewhat the longer. The peduncle of the superior pair is as long as the head, the first joint being longer than the two others. The first articulus of the flagellum is longer than the peduncle, tapering gradually to the extremity, and having the inferior margin fringed with hairs. The flagellum is very long and very slender, the articuli being about four or five times as long as broad, with the exception of a few succeeding the first long articulus.

The inferior pair have the peduncle reaching beyond that of the superior, and terminating abruptly, the flagellum being considerably narrower, and somewhat shorter, than that of the upper pair, although the articuli are similarly formed to those of the superior. In all other respects—except, perhaps, in the less unequal length of the caudal appendages—the description of *L. exulans* will suffice for this species also.

The near resemblance of this species with that of *L. Fabricii* (M. Edw.) of the Indian Ocean and *L. rubescens* (Dana) of the Pacific, is quite as remarkable as that existing between *L. exulans* and a species from Chili.

The first specimen which we received was sent to us by Professor Kinahan, who captured it off Carrickfergus, and in compliment to whom we have named the species.* We have since received it in considerable numbers from Mr. Edward, of Banff.

The colour, as far as we can judge from the dead animals, is that of a salmon tint, with a few small spots of dull red. The eyes are probably green.

* It is with much regret that we learn, while this sheet is passing through the press, that this able carcinologist has, at an early age, departed this life.

AMPHIPODA.
HYPERINA.

HYPERIIDÆ.

Genus—HYPERIA. (*Latreille.*)

- Hyperia.* LATREILLE, in DESMAREST's Consid. sur Crust. p. 258, 1825.
MILNE EDWARDS, Ann. des Sci. Nat. xx. p. 387. Hist. des
Crust. t. iii. p. 74. DANA, U. S. Explor. Exped. p. 986.
SPENCE BATE, Cat. Amph. Brit. Mus. p. 292.
Metoechus. KRÖYER, Grönl. Amphip. p. 60. MILNE EDWARDS, Hist. des
Crust. iii. p. 78.
Tauria. DANA, U. S. Explor. Exped. p. 988.
Hiella. STRAUSS, Mém. du Muséum t. xviii.

Generic character. Cephalon large, orbicular. Eyes large, occupying most of the lateral, and encroaching upon the frontal, walls of the head. Antennæ short, subequal. Gnathopoda nearly alike, small; first pair nearly simple, the second complexly subchelate. Pereiopoda subequal. Three posterior pairs of pleopoda biramose. Telson squamiform.

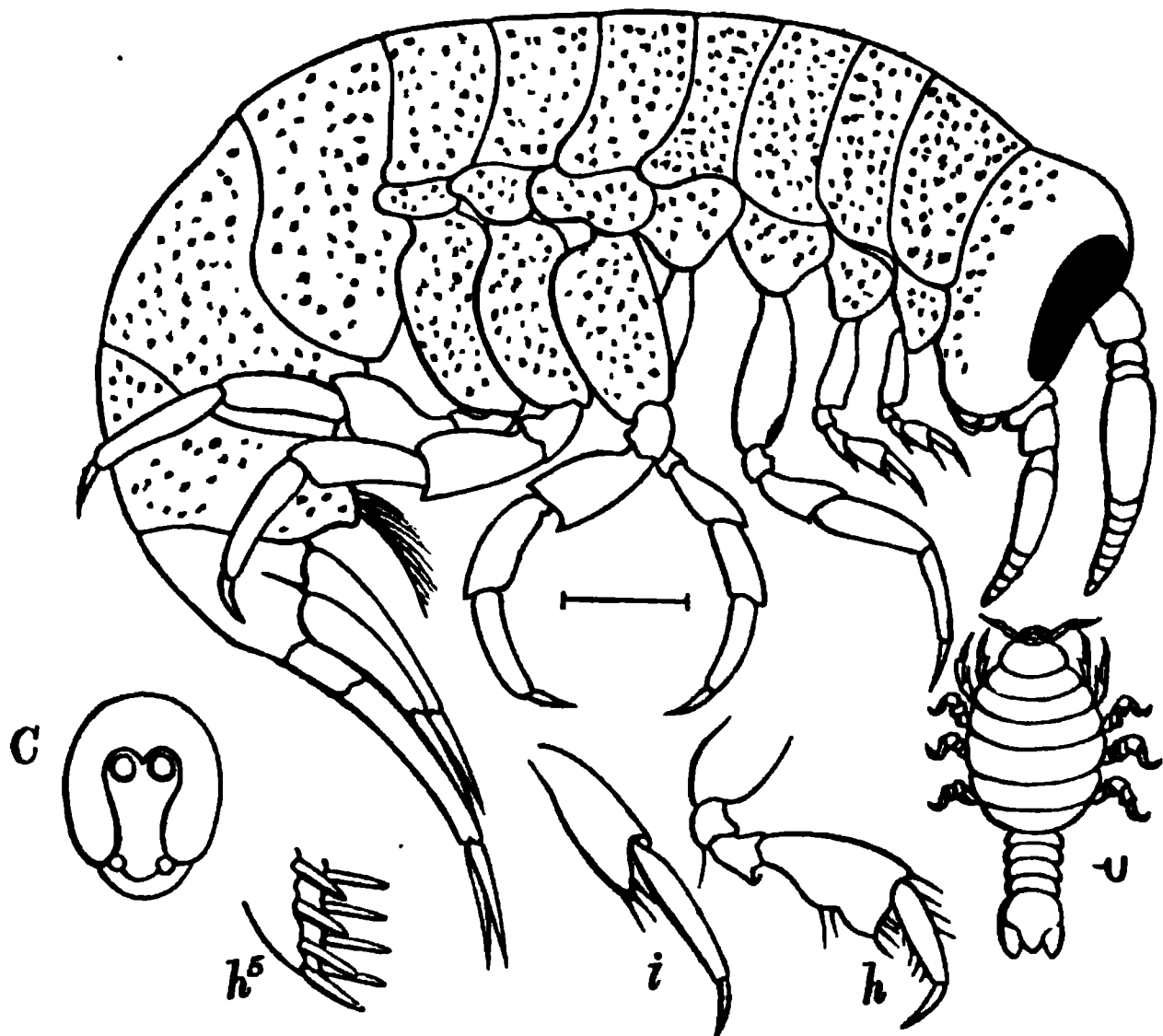
THE head is large and rounded. The body is broad and convex. The eyes occupy the greater portion of the lateral and dorsal walls, and encroach upon the frontal surface of the head. The antennæ are short, being never longer than the depth of the head, and nearly equal in length. The lower pair are inserted at a considerable distance from the upper. The arms are small and imperfectly prehensile, but formed upon the complex type so generally prevailing in this division of Amphipoda. The walking legs are nearly of similar length, and tolerably strong. The caudal appendages are biramose, and the middle piece consists of a small lanceolate scale.

Dana has, we think correctly, associated the genus METOECHUS of Kröyer with the present, from which it

only differs in the infero-anterior angle of the carpus being more strongly developed. Mr. Spence Bate has also, in the Catalogue of Amphipoda of the British Museum, incorporated Dana's genus *Tauria* for a similar reason—namely, that the wrists are only developed to a very small degree. In the same work Mr. S. Bate has also suggested that the species of the present genus are but the females of those of *Lestrigonus*. He arrived at this conclusion after examining a considerable number of species of both genera, finding that it is difficult, if not impossible, to assert (with reference to the structure of the antennæ) where one genus commences and the other ends. Recently, through the kindness of Mr. Edward, of Banff, we have had the opportunity of examining many fresh specimens both of *Lestrigonus* and *Hyperia*, from the same locality, and we found that all the adult *Hyperia* of which the sex could be detected were females, but that none of the *Lestrigoni* were of that sex.

AMPHIPODA.
HYPERINÆ.

HYPERIIDÆ.



HYPERIA GALBA.

Specific character. Cephalon large ; pereion distended ; pleon compressed. Antennæ short, having the flagella terminating in a few scarcely-visible articuli. First pair of gnathopoda having the carpus broad, but not obliquely produced ; second pair having the carpus infero-anteriorly produced. Peduncle of the posterior pair of pleopoda reaching to the apex of the rami of the preceding pair. Telson lanceolate.

Length $\frac{1}{2}$ inch.

Hyperia Galba.

MONTAGU, Linn. Trans. xi. p. 4, pl. 2, fig. 2.
MILNE EDWARDS, Hist. des Crust. iii. p. 77.
W. THOMPSON, Ann. Nat. Hist. xx. p. 244.
WHITE, Cat. Crust. Brit. Mus. 1847 and 1850, p. 57. Hist. Brit. Crust. p. 206. GOSSE, Mar. Zool. p. 139. SPENCE BATE, Ann. Nat. Hist. 2 ser. xix. p. 150. Cat. Amph. Brit. Mus. p. 293, pl. xlviii. fig. 9.

Hyperia Latreillii.

MILNE EDWARDS, Ann. des Sci. Nat. xx. p. 388, pl. xi. fig. 1-7. Hist. des Crust. iii. p. 76. Règne An. (Ed. Crochard) Crust. pl. lviii. fig. 1.

GUBBIN, Icon. R. An. Crust. pl. xxv. fig. 5.

WHITE, Cat. Crust. Brit. Mus. 1847 and 1850.

Hist. Brit. Crust. p. 206, pl. xi. fig. 3. GOSSE,

Mar. Zool. p. 139, fig. 251.

Metoechus medusarum. WHITE, Hist. Brit. Crust. p. 207.

Hiella Orbignii. STRAUSS, Mém. du Muséum, vol. xviii. pl. 4.

THE head is large and rounded. The body is very considerably dilated, while the tail is much narrowed. The eyes are large and occupy nearly the whole surface of the head, distinguished by an exquisite soft tint of green when the animal is alive. The superior antennæ consist of a short peduncle (the last two joints of which are shorter than the first) and a flagellum, which is not quite so long as the depth of the head; this flagellum consists of a long articulus and a few faintly-marked terminal articuli, but these appear to be either not constant or only visible under treatment with liquor potassæ. The inferior antennæ are scarcely as long as the superior, and terminate in a flagellum nearly resembling that just described. The terminal articuli are, therefore, not to be depended upon as a specific character. The arms are small, and differ but slightly; the second pair have the hand somewhat the longer, and the wrist somewhat more infero-anteriorly developed than in the first pair; both have the margin of the wrist fringed with strong but not very sharp spines. The walking legs are nearly of one length, and tolerably robust. The caudal appendages are broad and flat, and have the rami serrated at the margins. The peduncle of the last pair reaches quite to the extremity of the preceding, and the middle piece consists of a small lanceolate scale.

The colour of the species, except the green eyes, is fawn, or faint yellow, passing into a salmon tint soon after the animal is put into spirits; it is also dotted all over with small specks of red.

We believe that Professor Milne Edwards was the first to point out the great difference of form existing between the young and the adult in this division of Amphipoda; but Mr. Gosse, in his pleasant "Naturalist's Rambles in Devonshire," has figured the young of this species. We also have had an opportunity of examining them, a drawing from which is given at figure -u * at the head of this description. The head of the young animal is small, and the eyes, consequently, are not much developed. The body is very large, while the tail is narrow and straight, and lies compressed beneath the body. Mr. Gosse has figured all the legs, but in our specimen two pairs appeared to be wanting. This may be accounted for by the circumstance that Mr. Gosse's specimens were older than ours, he having procured his as free and independent creatures, whereas ours were procured direct from the incubatory pouch. In the caudal appendages there also appears to be a difference in the degree of development as observed by Mr. Gosse and ourselves, arising, no doubt, from the above-named cause.

This species, which must be considered as the type of the genus, was first taken by Col. Montagu on the southern coast of Devonshire, and it has been sent to us from Jersey by Mr. George Parker. Specimens from a *Rhizostoma* at Lamboy in Ireland have been communicated to us in Mr. W. Thompson's collection, belonging to the Belfast Museum, and a number of specimens stated to have been also captured in the stomach of a *Medusa*, and given to us by the late lamented Rev. Professor Henslow. Mr. White records it as inhabiting the pouches of *Rhizostoma Cuvieri* on the Dublin coast upon the authority of Mr. Hyndman. Mr. Edward has sent it to us from

* This mark is intended to symbolize the young animal.

Banff, and Professor Milne Edwards mentions having found it on the shores of France.

Among several specimens sent to us from Banff, were a few of a smaller size, which differed from the others in having much shorter antennæ, the inferior being the shortest, and terminating in a more obtuse extremity than in the larger specimens. We were at first inclined to describe them as a distinct species, but, all other conditions being considered, we feel certain that they are only immature specimens, a circumstance which induces us to think that probably *H. medusarum* (Fabr.) of the Arctic sea may likewise be but the young of this or some other species.

The following vignette represents the little fishing village of Polperro, in Cornwall, a place that has been rendered attractive to naturalists as the scene of the labours, as well as the residence, of Jonathan Couch, Esq., F.L.S.

AMPHIPODA.
HYPERINÆ.

HYPERIIDÆ.

HYPERIA OBLIVIA.

Specific character. Superior antennæ as long as the depth of the cephalon; inferior antennæ longer than the superior and terminating in a multiarticulate flagellum. Gnathopoda subequal, carpi scarcely inferiorly produced. First and second pereopoda having the carpi considerably broader than the propoda. Three posterior pairs of pereopoda very long, subequal, and having the anterior margins fringed with fine comb-like cilia.

Length $\frac{1}{8}$ inch.

Hyperia oblivia. KROYER, Grönl. Amph. p. 70, pl. iv. fig. 19. MILNE EDWARDS, Hist. des Crust. iii. p. 77. SPENCER BATE, Ann. Nat. Hist. 2 ser. xix. p. 150. Cat. Amph. Brit. Mus. p. 289, pl. xlix. fig. 5. WHITE, Pop. Hist. Brit. Crust. p. 206.

THE head is deeper than long. The eyes are large, but the pigment in our dead specimen formed a black spot of distinct outline on the anterior edge of the

lateral wall. The superior pair of antennæ are about as long as the head is deep. The peduncle is short; the flagellum stout at the base, gradually tapering to the apex, and is marked with a few imperfectly-defined rings. The inferior antennæ are more slender than the superior, a little longer, and terminate in a multiarticulate flagellum. The hands can scarcely be described as subchelate, although they possess a tendency in the direction common to most animals in the division. The third and fourth pairs of legs are long, and have the wrists thicker than any other joint; the hands are long and slender and tipped with sharp fingers. The three succeeding pairs are also uniform in shape, and nearly of equal length, the last being rather the shortest; these have the sixth joint remarkably long, and have the anterior margin of each with the distal half fringed with short, straight, evenly-planted cilia, and a few scattered longer ones. The caudal appendages are rather long and slender.

The colour of this species, if we can trust to that of an animal that has been dead a short time, appears of a light straw, having the back starred with a few spots of black pigment.

We have frequently doubted whether this species strictly belonged to the present genus. But finding that it agreed very closely with *H. trigona*, of Dana, from Cape Horn, we have considered it desirable that it should remain therein for the present. The form of the first two pairs of walking legs differ from the more typical species. The two succeeding pairs of legs in their length and armature suggest a relationship to the genus *Cyllopus*, which is also supported by the form of the inferior pair of antennæ, but from that genus this

species is excluded by the length of the last pair of walking legs, which in *Cyllopus* are rudimentary.

This species was first taken by Krøyer, in Greenland, from whence it is also recorded by Milne Edwards. The specimen from which our description and figure are taken was sent to us from the Moray Frith by the Rev. Geo. Gordon, to whom we are indebted for the accompanying sketch, taken by Miss Gordon from a scene on that Frith.

DOUBTFUL SPECIES.

THE *Gammarus nolens*, Johnston (Zool. Journ. iii. p. 179) has been referred to the present family, as a species of the genus *Typhis* of Risso, without sufficient foundation,* and probably in consequence of its supposed relationship to *Montagua monoculoides*, which was mistaken by White and Gosse for a *Typhis*. *Vide* page 54. It is described as about three or four lines long, and not much compressed. The antennæ are not more than one-third the length of the body, the superior pair being the shortest; the first and second pairs of legs monodactyle; the first with a small hand, the second with the hand more dilated; the legs monodactyle and spinous; the two pairs of caudal processes having mucronate branches, and the middle tail-piece is simple, terminating in a papilla, without any terminal processes.

It is described as not being rare near Berwick-upon-Tweed, and as inhabiting confervæ, but we have not seen a specimen.

* *Typhis nolens*. WHITE, Cat. Crust. Brit. Mus. p. 78. SPENCE BATE, Ann. Nat. Hist. 2 ser. xix. p. 150. Rep. Brit. Assoc. 1860, p. 225.

Anonyx (?) nolens. WHITE, Pop. Hist. Brit. Crust. p. 169.

Fam. II.—PHRONIMIDÆ.

INFERIOR antennæ obsolete, in one sex at least. Organs of the mouth rudimentary. Third pair of pereopoda developed more or less perfectly into a prehensile organ.

This family corresponds with that of Dana, except that it does not include the genus *Phorcus*. It is divided into two sub-families, the PHRONIMIDES and PHROSNIDES, the former only of which has, as yet, been included in the Fauna of Great Britain.

Subfamily—PHRONIMIDES.

THREE posterior pairs of caudal appendages, biramose rami lanceolate.

This subfamily corresponds with Dana's division PHRONIMINÆ, exclusive of the genus *Primno*.

AMPHIPODA.
HYPERINA.

PHRONIMIDES.

Genus—PHRONIMA.

- Phronima*. LATREILLE, Hist. Nat. Crust. et Ins. vi p. 289. SPENCE BATE, Cat. Amph. Brit. Mus. p. 816.
Phronyma. LEACH, in Sam. Ent. Comp. p. 101.
Phronoma. SPENCE BATE, Ann. Nat. Hist. 2 ser. xix. p. 150.

Generic character. Cephalon large, broadest at the top, and gradually decreasing to the oral aperture. Eyes upon the dorsal surface of the cephalon. Superior antennæ imperfectly developed. Inferior antennæ obsolete. Mandibles without an appendage. Pereion broad and flat. Gnathopoda small; carpi having the infero-anterior angles produced. Pereiopoda, consisting of but six joints, third pair chelate. Pleon narrow. Three posterior pairs of pleopoda biramose, lanceolate. Telson small, single.

THE head in this genus is much broader at the top than at the mouth. The body is tolerably broad, and the tail is very narrow. The eyes are large, and placed upon the top of the head. The superior antennæ are but imperfectly developed, consisting only of two joints, one probably representing the peduncle, the other the flagellum, the latter armed along two-thirds of its distal length with about sixteen long flattened filaments. The inferior antennæ appear to be altogether wanting. The mandibles are without an appendage. The first two pairs of legs are small, and have the wrists inferiorly produced, and each terminates in a minute finger, flanked at the base on each side by a small wing-like process, which Mr. Spence Bate, in the Catalogue of the British Museum, has named *dactyloptera*. The remaining legs only possess

six joints in each, but which of the joints is missing is difficult to determine. Observing, however, that the finger in the first two pairs is reduced to a rudimentary condition, and knowing the tendency in this division for the wrist to assist in forming the prehensile condition of the organ, we presume that the last joint is either wanting or fused with the preceding. In one instance we have observed a minute dactylos at the extremity of the second pair of pereiopoda, but so minute that it was not appreciable to less than 60 diameter magnifying power, and it is most probable that it is absent from being generally worn away. (We have a parallel instance in the allied subfamily *Phrosinides*. In the genus *Phrosina* the number of joints is six, whereas in *Primno* it is seven. Five joints of the legs resemble each other in the two genera, but in *Primno* the finger is added to the extremity.) The fourth pair of legs are very perfectly chelate. The caudal appendages are biramose, the rami being short and spear-shaped. The middle tail-piece is small, and slightly emarginate at its extremity. The animals of this genus are generally to be met with in tropical and subtropical waters and the Mediterranean. The few specimens which we know to have been met with in the Temperate Zone, have been probably borne thither by various oceanic currents.

AMPHIPODA.
HYPERINA.

PHRONIMIDES.



D

PHRONIMASEDENTARIA.

Specific character. Cheliform organ on the third pair of pereopoda slender. The inner margins of each ramus of the chela furnished with one tubercle, both tubercles finely tuberculated.

Length 1 inch.

Cancer sedentarius.

FORSKÅL, Descript. Anim. Arab. p. 95.

Cancer (Gammarellus) sedentarius.

HERBST, Naturg. der Krabben, &c., ii. pl. xxxvi. fig. 8.

Phronima sedentaria.

LATREILLE, Gen. Crust. et Ins. i. p. 56. pl. ii. fig. 2. Hist. Nat. des Crust. et Ins. vi. p. 289, pl. lvi. LAMARCK, Hist. des Anim. sans Vert. v. p. 197. LEACH, Trans. Linn. Soc. xi. p. 355. SAMOUELLE, Ent. Comp. p. 101. DESMAREST, Cons. sur Crust. p. 257, pl. xiv. fig. 1 (after Risso). MILNE EDWARDS, Ann. des Sci. Nat. xx. p. 394; 2 ser. iii. pl. xiv. fig. 9. Hist. des Crust. iii. p. 93, pl. x. fig. 13. CUVIER, Règne Anim. 2nd edit. v. (edit. Croch.) pl. lviii. fig. 3.

GUERIN MÉN., Icon. R. An. Crust. pl. xxv. fig. 4. LUCAS, Expl. dans Algérie, t. v. fig. 5. WHITE, Cat. Mus. Brit. Mus. 1847, p. 50. Pop. Hist. Brit. Crust. p. 208, pl. xi. fig. 4. SPENCE BATE, Ann. Nat. Hist. 2 ser. xix. p. 152. Cat. Amph. Brit. Mus. p. 316, pl. L. fig. 1.

THE head is deeper than long, tapering gradually towards the mouth. The antennæ are short, and almost rudimentary, having but two joints, the basal one short, the second about four times as long, furnished with several membranous cilia along its distal portion. The upper lip is a broad, thin plate, with a deep and narrow notch in the middle. The mandibles consist of large and squami-form plates, having the cutting margin formed into a smooth hoe-like blade. The right blade is furnished with a small second articulate plate, and both have the molar process developed in the form of a flat plate, perpendicular to the cutting margin, and fringed with short cilia. The first pair of foot-jaws consist of a basal joint and two branches, the one being somewhat lance-shaped and flat, having the outer margin smooth, but the inner serrated; the teeth being curved anteriorly and slightly overlapping each other. The second branch is hollow, or cup-shaped, having the margin evenly pectinated. The second pair of foot-jaws also consist of a basal joint and two ciliated oval plates, pointed at the tips. The under lip also consists of a basal joint, rather longer than wide, terminated by two lateral pointed lobes, having a double row of serratures on the inner margin, and furnished with a third central acute inner lobe. The first two pairs of legs are very similar, having the infero-anterior margin of the wrist anteriorly serrated; and in the first it is a little more produced anteriorly than in the second. The hand is long, slender, cylindrical, and tapering. The finger is

short, terminating in a minute double point, and flanked on each side at the base with two little wing-like appendages. These are smooth and arcuated upon the upper margin, but straight and regularly pectinated along the lower. The next two pairs of legs are long and simple; the succeeding pair are developed into the form of a perfect claw, each branch having a tubercle near the base on the inner edge, these tubercles being finely tuberculated; the last two pairs of legs are short and simple. The natatory appendages are short, but have a robust peduncle. The caudal appendages resemble each other, but the penultimate pair are about half the length of the others. They consist of a long, slender peduncle and a couple of styliform branches. The middle tail-piece is very small.

Dr. Pagenstecher, of Heidelberg, has published a very interesting anatomical and physiological memoir on this species in Wiegmann's "Archiv für Naturgeschichte," for 1861, in which he has made us acquainted with the early and intermediate states of the animal. In the earliest condition the antennæ are very small, dilated, and jointless; the seven pairs of legs are of uniform size and shape, each consisting of seven joints, including the small basal joint by which it is attached to the body, and the very minute terminal hook. The joints of the tail are almost undeveloped, the whole tail being scarcely larger than the preceding segment. In the intermediate state the third and fourth pairs of legs are considerably elongated, and the fifth pair have become cheliferous.* The tail and its appendages have also acquired consi-

* The progress of development in this genus offers a curious contrast to that of *Brachyscelus cruscum* as described by Spence Bate, "Annals of Natural History" for July, 1861, in which the sixth pair of legs are cheliferous in the young stage, becoming simple in the adult.

derable development, although still shorter and comparatively more robust than in the perfect animal. The eyes, in the perfect state, have afforded very interesting details. In addition to the lateral pair of the ordinary form, connected with the lateral extremities of the brain, are a superior pair of organs of sight, the nerves of which are considerably elongated, arising from intermediate dilations of the brain, and terminating in a mass of small knobs. The basal portion of these nerve-filaments forms a dark red mass, so that, in these respects, the animal is quite analogous to *Ampelisca Gaimardii*, described in our Vol. i. p. 128.

The only specimen of this species which we have seen as a native of the British coast, is one in the British Museum, taken by Dr. Fleming on the 3rd November, 1809, at Burray, in Zetland, amongst rejectamenta of the sea. This specimen, unfortunately, is in a very dilapidated condition. We have, therefore, found it necessary to present our readers with a figure drawn from a specimen of unknown habitat, with which we have compared the British type. Other specimens from the Shetland Islands were obtained by the late Dr. Johnston, and exhibited by him before the Berwickshire Naturalists' Club in 1855 (Proceedings, iii. p. 212).

The animal is more abundant in warmer latitudes; and the fact of its having been found so far north is to be attributed, probably, to the currents of the Great Gulf Stream. Risso describes the animal as being transparent, shining, and covered with red spots. Desmarest says that it is to be found mostly in the cavities of *Pyrosoma* and *Beroë*. Several specimens of the *Phronimæ* within the latter animals, open at both ends, are preserved in the Hopcian Collection at Oxford; the cavity of the latter, in one instance, containing a large num-

ber of young *Phronimæ*, in company with their parent. In the British Museum is a specimen of *Doliolum papillosum*, of Delle Chiaje, from Naples, in which a specimen was found, and which is represented in our figures at the head of this description,* the small white dots representing small masses of calcareous matter. Mr. MacDonald has informed us that he has kept some alive while inhabiting specimens of *Doliolum*, and that it was chiefly through the agency of the crustacean that the medusa was propelled through the water, adding that as they progressed they frequently rolled over and over.

* Figured also by Delle Chiaje, "Animali Invertebrati, tav. xxiii. ; see also Otto, in "Nova Acta," xi. p. 313.

Group—ABERRANTIA.

THIS group is distinguished from the more typical Amphipoda by the abnormal condition or the absence of one or more segments of the pleon, as well as by the coxæ not being largely developed into scales, and being mostly fused with their respective segments of the pereion.

This group comprises the genus *Dulichia* together with the LÆMODIPDA, an order founded by Latreille to separate the genus *Caprella* from the ISOPODA, amongst which naturalists had previously arranged it.

It corresponds with the order LÆMODIPODA of Milne Edwards, including the family *Dulichiidæ* of Dana.

Fam. I.—DULICHIIDÆ.

PEREION six-jointed; the last two segments fused into one. The last segment of the pleon absent. Telson squamiform. Fifth pair of pereiopoda attached to the postero-inferior angle of the sixth segment. Posterior pair of pleopoda wanting.

In the typical forms of Aberrant Amphipoda, all the legs have the coxæ fused with the respective segments of the body, and the tail is reduced to a rudimentary condition. In CERCOPS the tail, though rudimentary in appearance, has, according to Kröyer's figure, but one segment wanting. The absence of the natatory appendages, as well as of the first two pairs of walking legs, approximates this genus to *Caprella*. It is clear, there-

fore, that the only persistent character distinguishing the ABERRANTIA from the NORMALIA is the absence of one or more segments from the tail. We are justified, consequently, in associating this family with the Aberrant rather than with the Normal group of Amphipoda, amongst which it has been previously arranged.

As yet, but a single genus is known belonging to this family.

The Vignette below represents a sketch taken by Dr. Walker of a jetty at New Brighton on the Mersey, off the mouth of which he took some animals of this genus.

AMPHIPODA.

DULICHIIDÆ.

Genus—DULICHIA (Kröyer).

Dulichia. KROYER, Nat. Tidsk. n.s. i. p. 521. Voy. en Scand. pl. xxiii.

fig. 1. SPENCE BATE, Ann. Nat. Hist. xx. p. 526.

Dyopedos. SPENCE BATE, Ann. Nat. Hist. 2 ser. xix. p. 150.

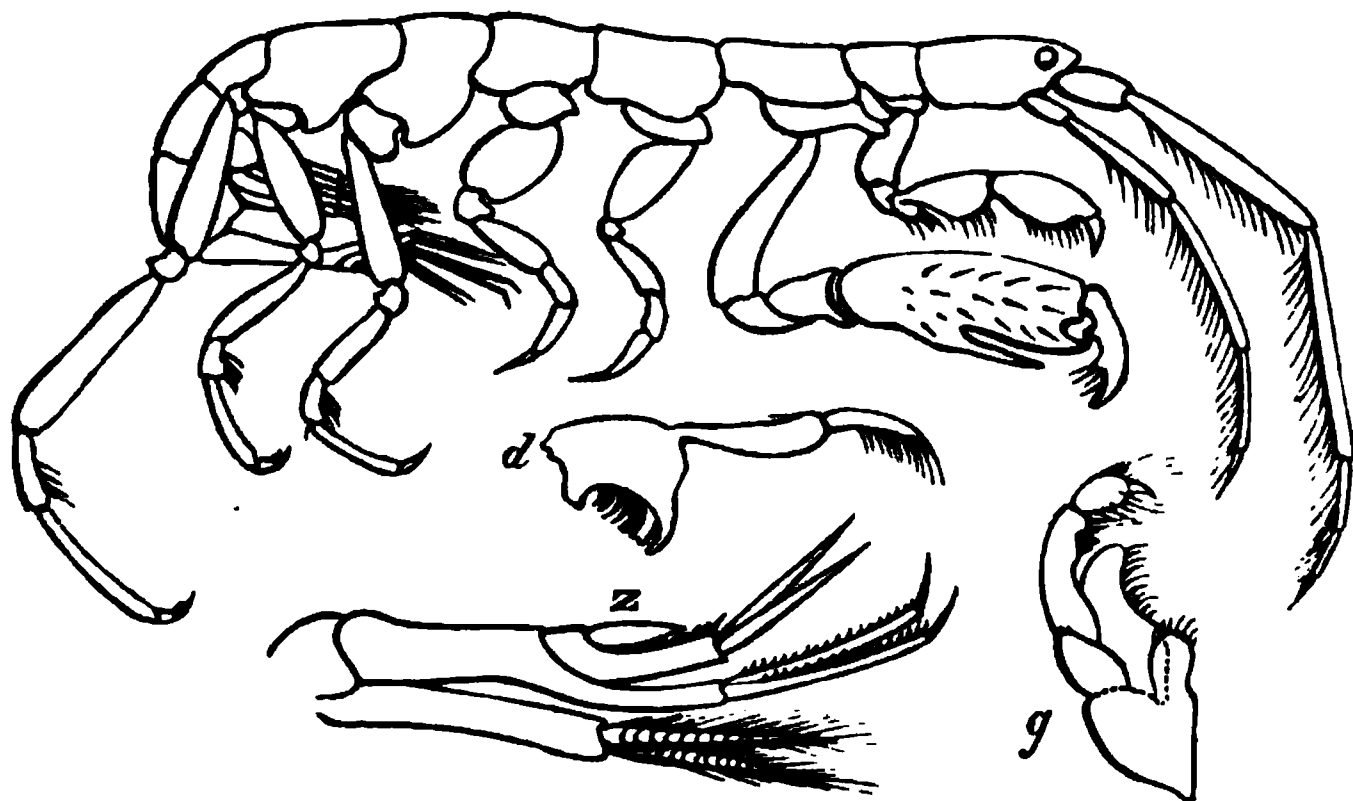
Generic character. Superior antennæ longer than the inferior. Inferior antennæ inserted posteriorly to the superior. Gnathopoda chelate. Pereiopoda subequal, having neither the coxæ nor basa developed into scales. Three anterior pairs of pleopoda normal; fourth and fifth terminating in two styliform rami; sixth obsolete. Telson single, lanceolate.

IN this genus the animals have the bodies long and narrow; the eyes normal; the superior antennæ longer than the inferior, both pairs carrying short flagella. The inferior pair arise farther back than the superior. The hands of the first two pairs of legs are more or less chelate. All the legs have the first joint small and squamiform, that of the last two pairs being fused with the fifth segment of the body. Each of the caudal appendages terminates in two styliform rami. The middle tail-piece is single and pointed.

This genus appears to be essentially arctic. It was from thence that Kröyer obtained the type of the genus, specimens of which we have seen attain the length of one inch and a quarter. The species taken on the northern shores of this island scarcely reach to the length of a quarter of an inch, while those from the western shores are still smaller.

AMPHIPODA.
ABERRANTIA.

DULICHIIDÆ.



DULICHIA PORRECTA.

Specific character. Cephalon not produced into a rostrum. Pereion and pleon dorsally smooth. Eyes round, not elevated upon a tubercle. Superior antennæ about half the length of the animal; flagellum shorter than the last joint of the peduncle. Second pair of gnathopoda having the propodos long and armed with two straight and anteriorly-directed teeth, the posterior one being the longer.

Length $\frac{1}{4}$ inch.

Dulichia porrecta. SPENCE BATE, Cat. Amph. Brit. Mus. p. 348, pl. liv. fig. 9. Ann. Nat. Hist. xx. p. 526. WHITE, Pop. Hist. Brit. Crust. p. 209.

Dyopodes porrecta. SPENCE BATE, Ann. Nat. Hist. 2 ser. xix. p. 151.

THIS species differs from *D. spinosissima*, on which Kröyer founded the genus, in the following particulars:—The head is not produced forwards into a sharp rostrum; the body and tail are smooth, being free from teeth or spines. The eyes are round, but not raised upon a stout tubercle. The superior antennæ are about half the length of the extended animal. The first joint of the peduncle is short and robust, but the two succeeding are long and slender. The flagellum (probably) is about half the length of the last joint of the peduncle.

The inferior antennæ are shorter than the superior, reaching scarcely to the extremity of the peduncle of the superior. The first pair of legs have the hand small, short, and oval, the palm being oblique and imperfectly defined. The second pair of legs are much larger than the first, and have the hand long, but not very broad. It is armed anteriorly and inferiorly with two long, straight teeth, directed forwards, the posterior being the longer. The finger is short, thick, and double-lobed upon the inner margin. The coxæ of the second pair of legs are produced in front to a point. The caudal appendages are sub-equal, and the middle tail-piece is pointed.

We first received this specimen from Mr. Gregor, of Macduff, who procured it from the Moray Frith, and subsequently from Dr. Walker, who took it in deep water between the rivers Dee and Mersey.

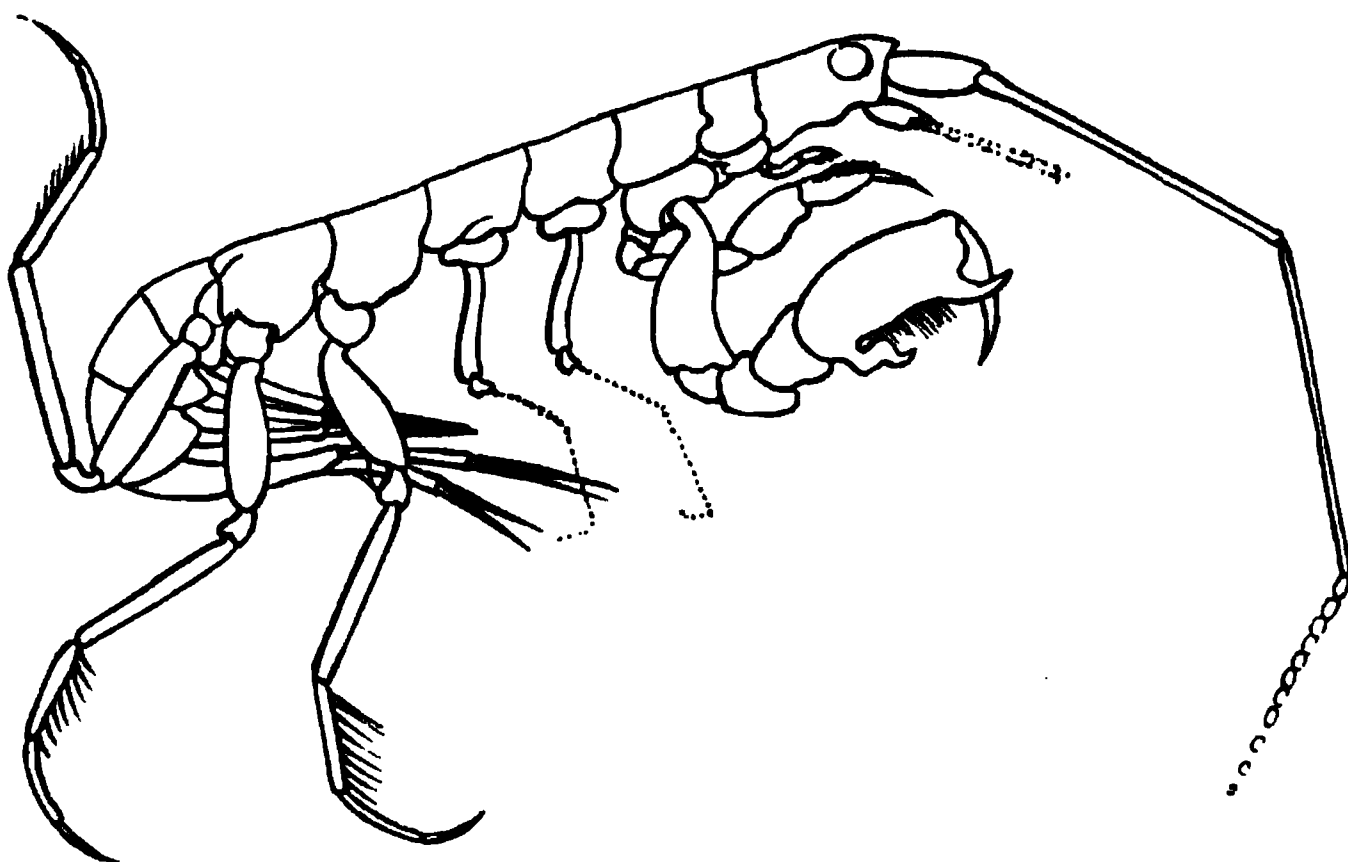
The specimens received from Dr. Walker differ from the type of the species so much that we hesitated in considering them identical. After full consideration, however, we feel assured that the alteration of form is one of variation, dependent upon some altered conditions in the history of the animal.

The specimens from the mouth of the Dee have the hand of the second pair of legs shorter, stouter, and more oval than in the type, but the armature is the same, except that the inferior tooth is not quite so far behind the first, and not directed so straight forwards.

One of these specimens was a female, and, fortunately, the larva were in a mature condition, which enabled us to ascertain that the absorption of the seventh into the sixth segment is a feature from the earliest existence of the animal. The larva is distinguishable from the adult by the shortness of the antennæ, the small sizes of the hands, and the shortness of the last pair of legs.

AMPHIPODA.
ABERRANTIA.

DULICHIIDÆ.



DULICHIA FALCATA.

Specific character. Cephalon without a rostrum. Body smooth. Superior antennæ about two-thirds the length of the animal. Second pair of gnathopoda having the propodos armed beneath with a crooked tooth near the base, and a sharp curved tooth near the distal extremity.

Length, $\frac{1}{4}$ inch.

Dulichia falcata. SPENCE BATE, Ann. Nat. Hist. xx. p. 526. Cat. Amph. Brit. Mus. p. 348, pl. liv. fig. 10. WHITE, Pop. Hist. Brit. Crust. p. 209.

Dyopedos falcata. SPENCE BATE, Ann. Nat. Hist. 2 ser. xix. p. 151.

IN general appearance this species closely resembles the preceding. The head is not produced into a rostrum. The body and tail are smooth, being free from teeth or spines. The eyes are round, and rather large. The superior antennæ are long, quite two-thirds the length of the animal. The first joint of the peduncle is shorter than the head, but each of the two succeeding (which are slender, and nearly of the same length) are three times as long as the first. The flagellum is not so long as the last

joint of the peduncle. In our unique specimen, which is also imperfect in other parts, the inferior antennæ are lost. The first pair of legs have the hand tapering to the distal extremity. The palm is very oblique, and but very imperfectly, if at all, defined. The second pair of legs are very robust, and have the hand long, the palm armed with two curved teeth, the distal tooth being sharp and slightly curved, the basal (by which the limit of the palm is defined) being crooked. The finger is rather long, sharp, curved, and slightly waved upon the inner margin. The third and fourth pairs of legs are smaller than the three succeeding, which are very long, and furnished with fine hairs upon the under surface of the fifth joint.

We also received this species from Mr. Gregor, of Macduff. It came to us mixed with *D. porrecta* and some imperfect specimens which had no teeth on the hand. These latter we believe to be females of this species.

It was taken in the Moray Frith.

Fam. II.—CAPRELLIDÆ.

PEREION cylindrical. Pleon rudimentary. Appendages attached to the cephalon normal and well-developed. Pereiopoda having the first joints, or coxæ, fused with the segments of the pereion to which they are respectively attached. Branchiæ attached to the third and fourth segments of the pereion. Pleopoda rudimentary or obsolete.

It is to the species belonging to the several genera in this aberrant family that the popular name of spectre or skeleton shrimp has been applied, the idea being suggested by their thin and skeleton appearance, as they crawl among the weeds under water.

The slender elongated form of these animals well contrasts with the short and dilated bodies of those composing the following family Cyamidæ. These animals also are free and roving in their habits, whilst the Cyami are parasitic upon the Cetacea, and evidently, from their structure, sluggish in their movements.

The Caprellidæ have recently been divided by Krøyer into several genera beyond those adopted in the following pages, founded, for the most part, on the relative structure of the minute terminal portion of the body, and the greater or less development of its rudimental segments and appendages. These characters appear, however, to us of too slight importance to warrant such a step, the more so since they only exist in an abnormal condition.

AMPHIPODA.
ABERRANTIA.

CAPRELLIDÆ.

Genus—PROTO.

- Proto.* LEACH, Linn. Trans. xi. p. 362, 1814. DESMAREST, Consid. sur Crust. p. 276, 1825. SPENCE BATE, Cat. Amph. Brit. Mus. p. 349.
- Leptomera.* LATREILLE, in CUVIER, Règne Animal, 1st ed. iii. p. 51, 1817. DESMAREST, Consid. sur Crust. p. 275. GUERIN, Iconograph, R. An. Crust. pl. xxviii. fig. 3. KROYER, Nat. Tidsk. iv. p. 496. MILNE EDWARDS, Hist. des Crust. iii. p. 109. GOSSE, Mar. Zool. i. p. 131.
- Naupredia.* LATREILLE, in CUVIER, Règne Animal, 2nd ed. iv. p. 128. Cours d'Entomol. p. 393. VAN BENEDEN, Faune litt. de Belgique.

Generic character. Cephalon confluent with the first segment of the pereion. Pereion having the last joint shorter than the preceding, cylindrical. Pleon rudimentary. Gnathopoda subchelate. Three anterior pairs of pereiopoda short and feeble, last two long and powerful.

IN this genus the head is small and globular, and so closely attached to the first segment of the body that it can only be distinguished from it by close observation. The body is cylindrical, and the tail is rudimentary. The eyes, antennæ, and organs forming the mouth are similar to those in the group NORMALIA, but the legs have the first joint closely fused with the respective segments to which they are attached. In this respect we perceive a resemblance to the development of the same parts in the highest organized decapods. Many genera of the *Brachyura* have the coxæ as closely anchylosed with the pereion as we here see exhibited in animals at the opposite extremity in the scale of development. The first two pairs of legs are subchelate, the second being the larger. The next four pairs are equidistant from each

other, while the seventh pair are much nearer the sixth. The fifth pair of legs are the shortest, the fourth pair being longer, and the third still a little longer. The last two pairs of legs are long and powerful. The branchiæ are attached to the second, third, and fourth pairs of legs. The tail is rudimentary, and the appendages attached to it almost obsolete.

The geographical range of this genus is, as yet, limited to the British seas and the adjacent coast, with the exception of a single specimen taken by Dana on the south-eastern shores of South America.

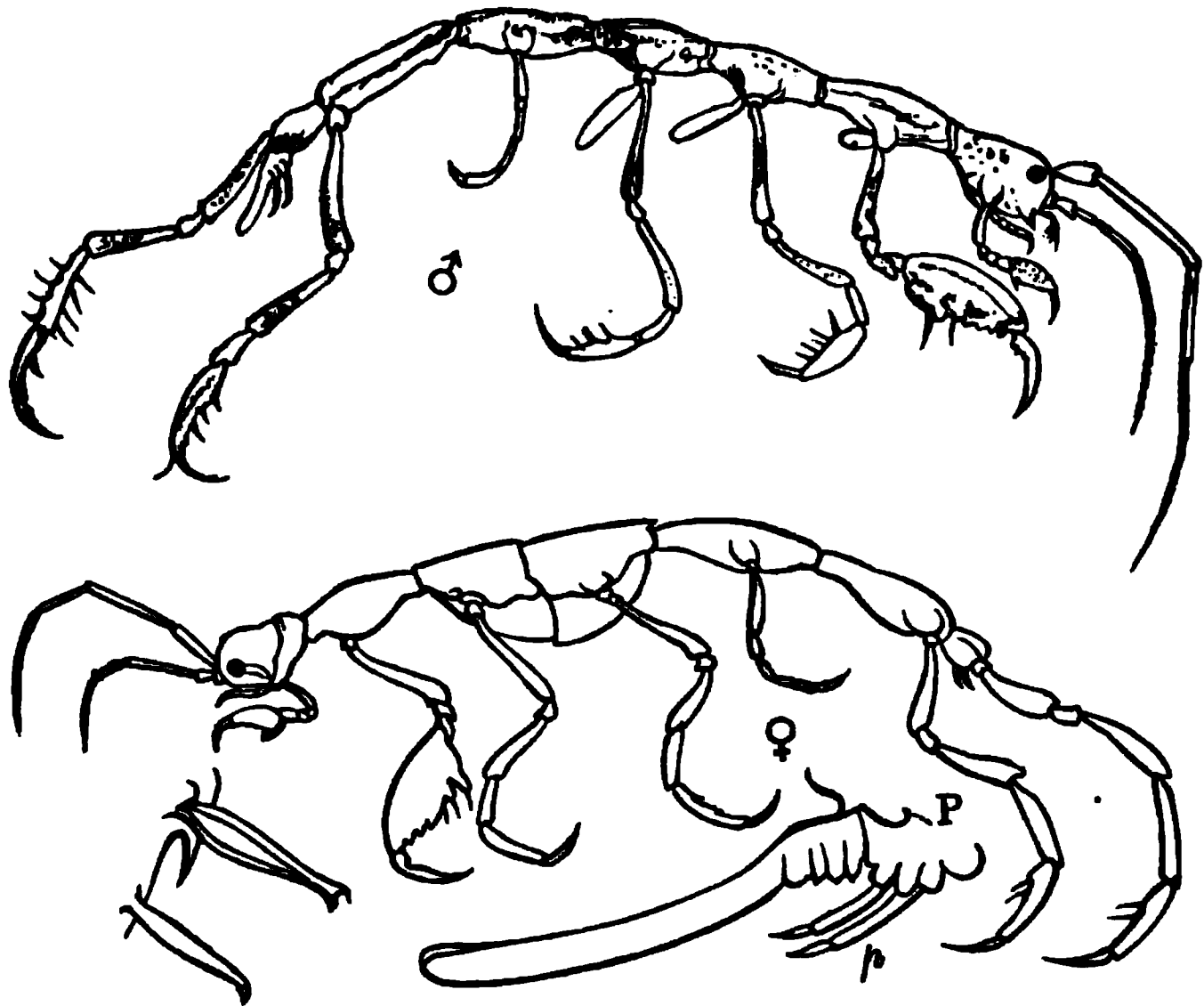
Latreille appears to have made much confusion respecting the nomenclature of the present group by attempting, in his different works,* to distinguish his genus *Leptomera* from that of *Proto* of Leach, proposing also a third generic name *Naupredia* (*Naupridia*, Milne Edwards), for an animal described as having only ten legs in a continuous series, those of the second, third, and fourth pairs having a vesicle at the base, and which is evidently a *Proto* with the sixth and seventh pairs of legs accidentally broken off.† He has evidently, also, fallen into error in giving the *Gammarus pedatus* of Montagu and of Müller and the *Squilla ventricosa* of Müller as three distinct species, referable to separate sections or subgenera.

* Règne Animal, 1st edit. iii. p. 51 ; 2nd edit. iv. pp. 127, 128. Nouv. Dict. d'Hist. Nat. 2nd edit. p. 433 (Art. *Chevrulle*) ; xvii. p. 485 (Art. *Leptomere*) ; xxviii. p. 177 (Art. *Proton*).

† Van Beneden (Recherches sur la Faune litt. de Belgique, Crust. 1861, p. 97, pl. xvii.) has described a species which he names *Naupredia tristis*, asserting that it is a perfect animal, and not a mutilated *Proto* (*Leptomera*). It is only five millimetres long, and is most probably in a very young state. It entirely agrees with *Proto*, except in the inarticulated flagellum of the antennæ and want of the four hind legs. It is possible that these may be subsequently developed ?

AMPHIPODA.
ABERRANTIA.

CAPRELLIDÆ.



PROTO PEDATA.

Specific character. Superior antennæ nearly half the length of the animal. Inferior antennæ about half the length of the superior. First pair of gnathopoda having the propodos triangular, palm oblique, armed with small spines, and defined by a sharp tooth. Second pair of gnathopoda having the propodos long, ovate; palm waved, being oblique nearly two-thirds the length of the joint, and defined by a process, armed with a strong spine.

Length $\frac{1}{3}$ inch.

Gammarus pedatus.

ABILDGAARD in MULLER, Zool. Dan pt. iii.
p. 33, pl. ci. figs. 1, 2.

Cancer (Gammarus) pedatus.

MONTAGU, Trans. Linn. Soc. xi. p. 6, pl. ii.
fig. 6.

Proto pedata.

FLEMING in Edin. Phil. Journ. viii. p. 296.
LEACH, in Edin. Encyc. vii. p. 433. Trans.
Linn. Soc. xi. p. 362. SPENCE BATE, Rep.
Brit. Assoc. 1855. Ann. Nat. Hist. 2 ser.
xix. p. 151. WHITE, Pop. Hist. Brit. Crust.
p. 218. Cat. Brit. Crust. p. 61. JOHNSTON,
Mag. Nat. Hist. viii. p. 673, figs. 72, 73.

- Proto pedatum.* DESMAREST, Consid. sur Crust. p. 276.
Leptomera pedata. GOSSE, Mar. Zool. p. 181. fig. 224.
Leptomera pedata. LATREILLE, Règne An. iii. p. 51. GUERIN, Iconogr. Crust. pl. xxviii. fig. 8. MILNE EDWARDS, Hist. des Crust. t. iii. p. 109. KROYER, Nat. Tidssk., iv. p. 607, pl. vii. figs. 13-23. DESMAREST, Consid. sur Crust. p. 276, pl. xlv. fig. 8.
Squilla ecaudata (Female). GRONOVIVS, Act. Helv. p. 489, pl. iv. figs. 8, 9, 10.
Squilla ventricosa. MÜLLER, Zool. Dan. pt. ii. p. 20, pl. lvi. figs. 1, 2, 3.

THE animal is long, linear, cylindrical, and smooth, the head being intimately soldered with the first segment of the body. The eyes are small and round. The superior antennæ are about half the length of the animal; the flagellum being as long as the last two joints of the peduncle. The inferior antennæ are about half the length of the superior, the flagellum being about half the length of the peduncle. The first pair of legs are small, having the hand acutely triangular, tapering to the finger. The palm is as long as the posterior margin, and armed with two or three rows of minute spines, its limit being defined by a sharp process, carrying one or two spines. The second pair of legs are at a considerable distance from the first, and situated near the middle of the second segment of the body. They are as long again as the first, and the hand is about twice as long and broad as that of the preceding pair. It is of a narrow oval form, having the palm more than half the length of the hand, defined by a sharp process, furnished with a small, stout spine; it is excavated near the posterior limit, is wavy throughout its length, and armed with small processes tipped with spinules.* The third pair of legs are feeble

* Dr. Johnston describes two varieties of this species—the first having the hands oval, with a single denticle at the base, the head rounded in front, and the branchial lamellæ large and elliptical (to which the figures of Müller

in appearance, and have the posterior margin of the penultimate joint armed with four radiating spines. The fourth pair are like the third, but smaller, while the fifth are so much smaller and imperfect in their condition as to partake of a rudimentary character. They are, moreover, directed backward; that is, contrary to the two posterior pairs, and therefore contrary to its normal condition. The two posterior pairs of legs are attached near together, in consequence of both being situated at the posterior extremity of their respective segments, the last of which is much shorter than any of the others.

This single feature is sufficient to enable the observer to detect an animal of this genus, however otherwise damaged, since in *Caprella*, &c., the last two joints are always short, and hence the last three pairs of legs are always in close juxtaposition. The last two pairs of legs are longer than the others, and have the penultimate joint, for nearly two-thirds of its length, armed with two spines, opposed to the extremity of the finger which closes upon the preceding joint. The tail is rudimentary, consisting, when recent, of a cylindrical tube, without any limbs except two pairs of rudimentary, styliform appendages, situated near the extremity of the preceding segment, which probably fulfil the same office as their homologues in the male brachyurous crustacea.

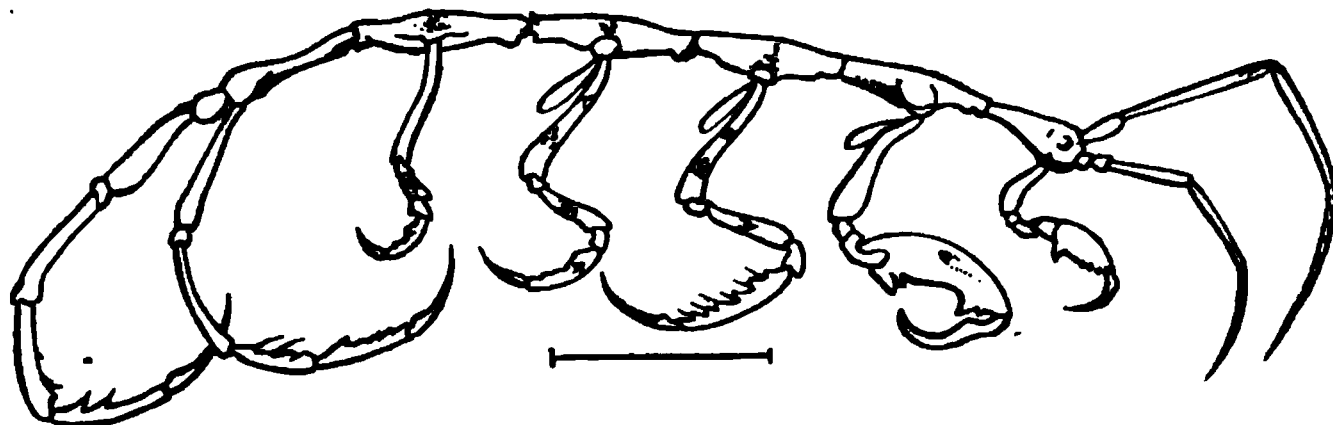
We anticipate that the geographical distribution of this species will be ultimately found to be more general than our experience has yet ascertained. It was first taken as British by Montagu on the southern coast of

and Montagu belong); and the second with the first pair of hands triangular, somewhat lobed at the base, the wrist deeply serrated, the second pair of hands oval with two teeth at the base, and serrulate along the palm, head very obtuse in front, and the branchial lamellæ smaller and cylindrical (to which all the Berwick specimens are referable).

Devonshire, where we have likewise found it. The Rev. Mr. Gordon has sent it to us from the Moray Frith; so also have Mr. Gregor and Mr. Edward. The Rev. A. M. Norman has taken it in about forty fathoms one mile north of Whalsy lighthouse, in the Shetlands, and Milne Edwards records it from Denmark, where, in fact, the species was first discovered. Dr. Fleming found it at the Bell Rock, and Dr. Johnston in Berwick Bay, and Mr. R. Q. Couch at Mousehole Island, Cornwall.

AMPHIPODA.
ABERRANTIA.

CAPRELLIDÆ.



PROTO GOODSIRII.

Goodsir's Spectre Shrimp.

Specific character. Superior antennæ about one-third the length of the animal. Inferior antennæ about one-half the length of the superior. Second pair of gnathopoda having the propodus large, arcuate above, palm excavated, and armed beneath, near the base and distal extremity, with a small tooth.

Length $\frac{3}{4}$ inch.

Proto Goodsirii. SPENCE BATE, Ann. Nat. Hist. 2 ser. xix. p. 151. Cat. Amph. Brit. Mus. p. 350, pl. lv. fig. 2. WHITE, Pop. Hist. Brit. Crust. p. 218.

THIS species is a larger and more powerful-looking animal than *P. pedata*, from which it differs chiefly in the form of the second pair of hands.

The superior antennæ are about one-third the length of the animal, and the flagellum is about as long as the peduncle. The inferior antennæ are about half the length of the superior—that is, scarcely reaching to the extremity of the peduncle of the latter. The first pair of legs have the hands elongate-ovate, broadest at the base, and narrowed at the extremity; palm very oblique, slightly convex, minutely serrated, defined near the posterior extremity by an obtuse tooth. The second pair of legs have the hands very large, rounded above, and having the palm

concave, and frequently furnished with one or two sub-membranous hollow sacs. This latter feature (if our experience has not deceived us) is present only after death. We have observed this structure only in this family, and Dana has likewise figured it. The palm is armed near the base and distal extremity with two small teeth; the finger is much curved, and its extremity alone impinges against the palm. The third pair of legs are rather longer than the second, and have the hand serrated and furnished with a few cilia. The fourth pair are like the third, but shorter; the fifth are still shorter. The sixth and seventh are long and powerful, having the wrists, as well as the hands, furnished with uneven teeth and a few hairs. The tail is very rudimentary, and supports in the male a single pair of rudimentary propoda. The branchiæ are attached to the second, third, and fourth pairs of legs.

This species has been named in honour of the lamented Mr. Goodsir, who promised fairly to distinguish himself in this branch of Natural History. It appears to be a northern species, since we have received it only from the Moray Frith, through the kindness of the Rev. George Gordon, from the Shetlands, where it was dredged by the Rev. A. M. Norman, and who also has found it on the coast of Durham.

AMPHIPODA.

CAPRELLIDÆ.

ABERRANTIA.

Genus—PROTELLA.

Protella. DANA, U. S. Explor. Exped. p. 812. SPENCE BATE, Cat. Amph. Brit. Mus. p. 351.

Generic character. Cephalon confluent with the first segment of the pereion. Pereion having the last two segments shorter than the preceding. Pleon rudimentary. Appendages to the cephalon well developed. Gnathopoda subchelate; first two pairs of pereiopoda rudimentary, but having branchiæ attached; last three pair subequally long and robust. Anterior pair of pleopoda rudimentary, the rest obsolete.

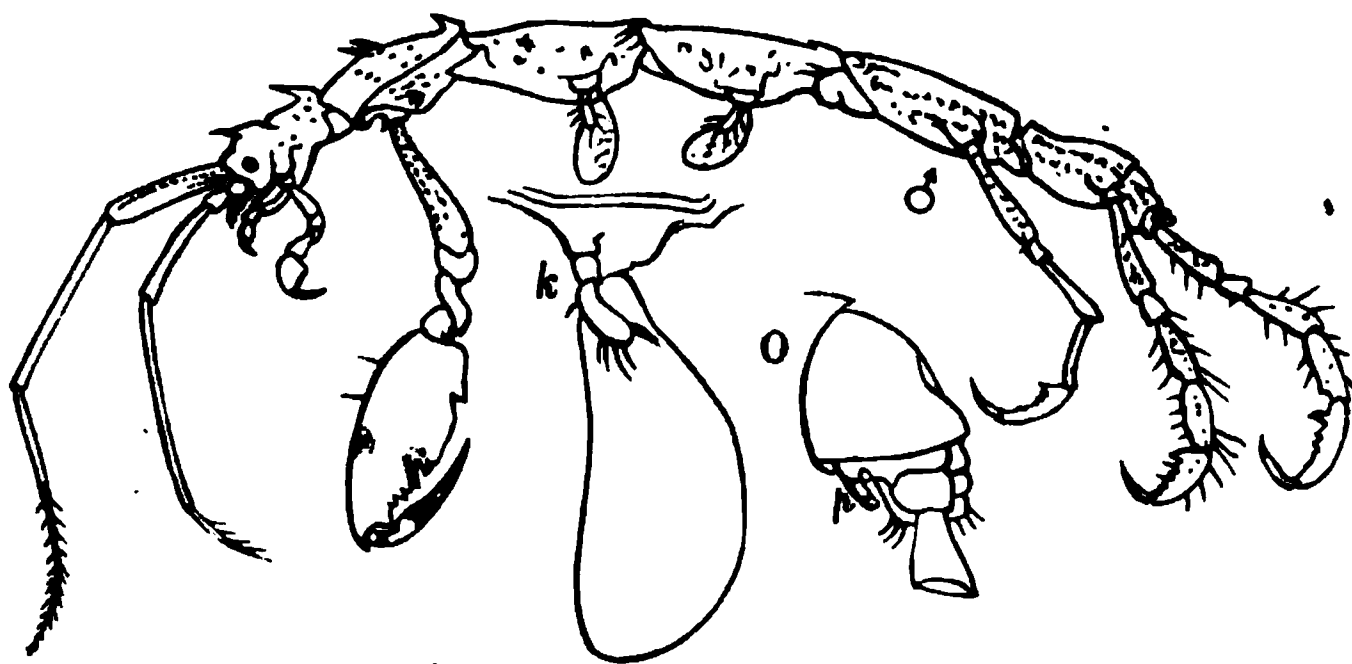
THIS genus differs from *Proto* in several important points: among the most conspicuous is the very rudimentary character of the third and fourth pairs of legs, which are represented by two small, uni-articulate, leaf-like plates. The penultimate segment of the body is as short as the last; consequently, the last three pairs of legs are situated closely together at the posterior extremity of the animal. Branchiæ are attached to the third and fourth segments of the body, which, in the female, have also attached the plates belonging to the incubatory pouch.

This genus was established by Dana, as possessing a character intermediate between that of *Proto* and *Caprella*, from which last it is distinguished by the character of the appendages of the intermediate segments of the body.

Our knowledge of this genus is, as yet, confined to two species, one belonging to Britain, the other to South America; therefore its geographical range cannot properly be estimated.

AMPHIPODA.
ABERRANTIA.

CAPRELLIDÆ.



PROTELLA PHASMA.

Montagu's Skeleton Shrimp.

Specific character. Cephalon, without a rostrum, dorsally armed with a strong spine, originating in the posterior margin and directed upwards and forwards. First segment of the pereion dorsally and posteriorly armed with a strong tooth; second segment similarly armed with a pair near the middle, and one near the posterior margin.

Length rather more than half an inch.

Cancer phasma.

MONTAGU, Trans. Linn. Soc. vii. p. 66, pl. vi. fig. 3.

Caprella phasma.

LAMARCK, Syst. des An. sans Vert. v. p. 174.

Caprella phasma.

LATREILLE, Encyc. Met. p. 336, fig. 87.

LEACH, Edin. Encyc. vii. p. 404. Enc. Brit. Suppl. 1, p. 426. SAMOUELLE, Ent. Comp. p. 105. DESMAREST, Consid. sur Crust. p. 278. MILNE EDWARDS, Hist. des Crust. iii. p. 108. WHITE, Cat. Crust. Brit. Mus. 1847. Cat. Brit. Mus. 1850, p. 60. Pop. Hist. Brit. Crust. p. 216. FLEMING in Edin. Phil. Journ. viii. p. 297. JOHNSTON in London's Mag. Nat. Hist. viii. p. 669. RATHKE, Nov. Act. xx. p. 95. GOSSE, Mar. Zool. p. 223. R. Q. COUCH, Rep. Penzance, N. H. Soc. 1852, p. 96.

Ægina longispina.

KROYER, Nat. Tidsk. 2 ser. i. p. 476, 1844-6.

Protella longispina.

SPENCE BATE, Ann. Nat. Hist. 2 ser. xix. p. 151.

*Caprella spinosa.*GOODSER, Edin. Phil. Journ. xxxiii. pl. 3,
f. 1-3. WHITE, Pop. Hist. Brit. Crus. p. 197.*Protella phasma.*SPENCE BATE, Cat. Amph. Brit. Mus. p. 351,
pl. lv. fig. 4.*Astacus phasma.*PENNANT, Brit. Zool. iv. p. 27, Edit. 1812
(descr. only).

THE head of this species is rounded in front, while a sharp, strong tooth, directed forwards as well as upwards, is situated upon the dorsal surface of the posterior margin just where the head is contiguous with the first joint of the body, from which it can scarcely be identified. The first joint of the body is likewise furnished with a similarly strong, sharp-pointed tooth, situated near its posterior margin. The second segment carries near the centre a pair of strong teeth, one on each side of the dorsal median line, as well as a third, situated in the middle of the dorsal surface, near the posterior margin. The third and fourth segments exhibit rudimentary processes, probably representing teeth in similar positions. The superior antennæ are rather more than half the length of the animal. The inferior antennæ are about half the length of the superior. The first pair of legs are short; the hand triangular; the palm defined by a sharp process. The second pair are very much longer; the hand is large, elongate-ovate, the palm having a deep excavation near the anterior extremity, and defined by a prominent blunt tooth, surmounted by one or more spines. The finger articulates with the hand somewhat before the apex, so that a sharp process is produced above and beyond the articulation. The three posterior pairs of legs have the hands arcuate, the anterior margin being armed with small tubercles, surmounted by a spine, and defined by a strong process, which is surmounted by several short spines directed towards the extremity, and

corresponding with the extremity of the finger when closed.

The female appears to differ in no essential character from the male, except in the possession of the ovigerous sac, the plates of which are attached to the third and fourth segments of the body.

Col. Montagu, who was the discoverer of this species, was also the first to observe the love that exists between the parent and the offspring in this group of Crustacea. He writes, in the seventh volume of the Transactions of the Linnean Society:—"While examining a female in a watch-glass of sea-water under a microscope, we were agreeably surprised to observe not less than ten young ones crawl from the abdominal pouch of the parent, all perfectly formed, and moving with considerable agility on the body of the mother, holding fast by their hind claws, and erecting their heads and arms."

This species is generally of a straw colour, delicately spotted with pink, fine specimens having the fingers banded with pink. As in all cornuted species, the spines on the head and the armature of the hands vary greatly. The animal represented by Goodsir under the name of *C. spinosa* has the occipital and dorsal horns of large size, as well as those upon the second pair of hands.

This species appears to be more abundant in the southern parts of Great Britain than in the northern, although we have it recorded from one extremity to the other. It was first found in Devonshire by Col. Montagu, and we have frequently obtained it in the neighbourhood of Plymouth. Mr. Gregor has sent it to us from the Moray Frith. Dr. Fleming obtained it from the Isle of Man, while Mr. Goodsir records it from the Frith of Forth. The Rev. A. M. Norman has taken it at Cullercoats, Northumberland, and Mr. R. Q.

Couch among confervæ, at Lariggan Rocks, Mount's Bay, Cornwall. In Norway it has been recorded by Rathke, and Krøyer has procured it at Christiana in Sweden.

The following vignette represents one of these spectre-shrimps prowling through the deep recesses of a submarine graveyard, such as Clarence dreamt of when he said :—

“ Methought I saw a thousand fearful wrecks,
A thousand men that fishes gnawed upon,
Wedges of gold, great anchors, heaps of pearl,
Inestimable stones, unvalued jewels,
All scattered at the bottom of the sea.
Some lay in dead men's skulls; and in those holes
Where eyes did once inhabit, there were crept
(As 'twere in scorn of eyes) reflecting gems,
That woo'd the slimy bottom of the deep,
And mocked the dead bones that lay scattered by.”

AMPHIPODA.
ABERRANTIA.

CAPRELLIDÆ.

Genus—CAPRELLA.

- Caprella* LAMARCK, Hist. des Anim. sans Vert. p. 165. LEACH, Linn. Trans. xi. p. 363. MILNE EDWARDS, Hist. des Crust. iii. p. 105. KRÖYER, Nat. Tidssk. iv. p. 496.
Ægina. KRÖYER, Nat. Tidssk. iv. p. 509.
Podalirius. KRÖYER, Nat. Tidssk. 2 Ser. i. p. 288.

Generic character. Cephalon confluent with the first segment of the pereion. Pereion cylindrical, with the last two segments shorter than the two preceding; in the male the first two segments are long, in the female they are shorter. Pleon rudimentary. Appendages of the cephalon normal. Gnathopoda subchelate; in the male the second pair of gnathopoda articulates with the pereion near the middle or posterior extremity of the second segment, in the female at the anterior extremity of the same segment. First two pairs of pereiopoda wanting. Three posterior pairs subequal, and placed near to each other. One or two pairs of pleopoda rudimentary, the rest obsolete.

THE head is confluent with the body. In the male the first segment of the body is longer than in the female, and the first pair of legs are always attached at the anterior extremity. The second segment is longer in the male than in the female, and we are strongly inclined to believe that it increases in length with the age of the animal. The second pair of legs always articulate, in the female, at the anterior extremity of this segment; whereas in the male they are affixed farther back, and generally posteriorly to the centre of the segment, and

sometimes quite at its extreme posterior limit. The three succeeding segments are generally of equal length, while the last two are always very short.

Mr. Goodsir, who paid considerable attention to this family, says, in the "Edinburgh Philosophical Journal" for 1842 (vol. xxiii. p. 186):—"The *Caprellæ*, like all the lower Crustacea, cast their skins often. Before the process commences, the animal lies for a considerable time languid, and to all appearance dead. At length a slight quivering takes place all over the body, attended in a short time with more violent exertions. The skin then bursts behind the head in a transverse direction; and also down the mesial line of the abdominal surface. A few more violent exertions then free the body of the old covering. After this the animal remains for a considerable time in a languid state, and is quite transparent and colourless."

The habits of these animals have not been much observed, living, as they do, amidst sea-weeds and zoophytes. They are active in scrambling from branch to branch, and are very likely to be overlooked. Mr. Goodsir, indeed, says that they are never seen to catch their prey, and "being slow and deliberate in their motions, they are not fitted for this mode of life;" to which we cannot subscribe, inasmuch as our experience would induce us to pronounce them to be active and energetic creatures. They generally grasp the objects to which they are attached by their strong posterior legs, and elevating themselves in an erect position, wave about their long antennæ, probably in search of food. "Their usual mode of progression" is compared by Otho Fabricius (Faun. Grönl.), Montagu, Goodsir, and Gosse, "to that of the larvæ of the Geometric moths." "They sometimes," says Mr. Goodsir, "walk in this way for a consi-

derable time, and then suddenly stop, remaining perfectly motionless, not even moving their antennæ."

They seldom attempt to swim, and will, when placed in the water independently of anything to rest upon, generally drop listlessly to the bottom. Mr. Gosse says, in his pleasant Naturalist's Rambles on the Devonshire Coast, "I have seen a large red species swim, throwing its body into a curve like the letter S, with the head bent down and the limbs turned back, the body being in an upright position. It was a most awkward attempt; and though there was much effort, there was little effect."

Kröyer has separated from this genus two others upon characters which appear to us to be very doubtful. The tail in *Caprella* is rudimentary, and exists in a semi-membranous condition. The development of this abnormally rudimentary part is, within small limits, variable. Upon the degree of its development Kröyer has founded the genera *Podalirius* and *Ægina*. It is only after a careful consideration of the structure of the animals that we have arrived at the conclusion that the establishment of these two genera is unnecessary. The genus *Cercops* also of Kröyer is mainly distinguished from *Caprella* by the small terminal abdomen being six-jointed and styliferous, but the second pair of legs have a vesicle at the base, as in *Proto*.

The geographical distribution of this genus is very universal, since species are recorded from almost every locality that has been visited by the carcinologist.

AMPHIPODA.
ABERRANTIA.

CAPRELLIDÆ.



CAPRELLA LINEARIS.

Pennant's Skeleton Shrimp.

Specific character. Cephalon and persion smooth and unarmed. Second pair of gnathopoda in the male having the propodus with the palm armed with a single tooth, in the female with two small tubercles, and in both defined by a short process armed with a spine.

Length $\frac{1}{2}$ inch.

Cancer linearis.

LINNÆUS, Syst. Nat. ii. p. 1056? Herbat.
Krabben, ii. pl. xxxvi. fig. 9, 10.

Caprella linearis.

MILNE EDWARDS, Hist. des Crust. iii. p. 106.
DESMARSET, Consid. sur Crust. p. 278. LA-
TREILLE, Hist. n. Crust. et Ins. vi. p. 324,
pl. lvii. fig. 2-5. JOHNSTON, Mag. Nat. Hist.
viii. p. 672, fig. 71. RISSO, Crust. de Nice,
p. 130. GOODSER, Edin. New Phil. Journ.
xxxiii. p. 190, pl. iii. fig. 8. R. Q. COUCH,
in Rep. Penzance, Nat. Hist. Soc. 1852, p. 98.
SPENCER BATE, Ann. Nat. Hist. 2 ser. xix. p.
151. Cat. Amph. Brit. Mus. p. 353, pl. lv.
fig. 7. WHITE, Cat. Brit. Crust. p. 59. Pop.
Hist. Brit. Crust. p. 214.

- Cancer (Astacus) atomos*? PENNANT, Brit. Zool. ed. 1777, iv. p. 17, pl. xii. fig. 32. BASTER, Opusc. Suba. pl. iv. fig. 2.
Cancer (Astacus) punctata. RISSO, Crust. de Nice, p. 130. Hist. Nat. Eur. merid. v. 102.
Oniscus scolopendroides. PALLAS, Spic. Zool. ix. p. 78, pl. iv. fig. 15.
Squilla quadrilobata? MÜLLER, Zool. Dan. ii. pl. xxxvi. fig. 4-6, male; iii. pl. cxiv. fig. 11, 12, female.

THIS species must be considered as the type of the genus. It has the head and back unarmed. In the male the first segment of the body is longer than in the female, as is also the second segment; the three succeeding are subequal in length, and a little shorter than the second; the last two are but half the length of the preceding. The superior antennæ are about half the length of the animal, the peduncle being rather longer than the flagellum. The inferior antennæ are about half the length of the superior, reaching scarcely to the extremity of its peduncle. The first pair of legs are short, and articulate with the first segment of the body at the anterior extremity: the hand is ovate, the palm very oblique, straight, ciliated, and defined by a process or tooth: the finger is serrated, and slightly curved. The second pair of legs are a little longer than the first, and articulate with the second segment just at the centre, but in the female a little more anteriorly; the hand is long-ovate, having the palm defined by a process or tooth, tipped with a spine, and armed with a tooth situated anteriorly to the centre, and just before which is a square-angled tooth or process. The last three pairs of legs are short, robust, and have the hand excavated in front, and armed with two small spines, which antagonize with the extremity of the finger when closed.

The incubatory pouch is an appendage which is developed when required for the purpose of carrying the ova, as shown in the two figures given below. It con-

sists of four plates, two attached to the third, and two to the fourth, segment of the body, arising upon the under surface and the inside of the branchiæ. We have observed this organ in various stages of development, from the small pedicle to the shell-like scale.

The habits of this animal are curious, and repay the naturalist for some patient observation. We have already noticed the parental affection existing between animals in this order and their offspring. In more than one species of this genus similar observations have been made. As soon as the young are old enough to enjoy a separate state of existence they quit the protection of the ovigerous pouch in which they have been nurtured, and, passing out, climb, gipsy-like, to the back of their mother, where they may be seen holding on in every conceivable attitude. Mr. Goodsir, in writing of this display of maternal care, says:—"On one occasion, while examining a female *Caprella* under the microscope, I found that her body was thickly covered with young ones. They were firmly attached to her by means of their posterior feet, and they were resting in an erect posture, waving about their long antennæ with great activity," as represented in the vignette given in a subsequent page.

In the national collection is preserved a specimen of an exotic species in which death has not separated the parent from the offspring. They may still be seen attached, as if climbing from the incubatory pouch to the back of the parent.

They live mostly amongst weeds and submarine growths, and "are as much at home in the tree-like zoophyte as a family of monkeys in their arborial bowers; and, indeed, their agility, as they run from branch to branch, catching hold of a twig just within reach and

pulling themselves in an instant up to it, then stretching out their long arms in every direction, strongly reminds one of the spider-monkeys of South America." *

In 1854 Mr. P. H. Gosse sent us some minute specimens of *Caprellæ* which he had found in considerable numbers on the rays of a small specimen of *Solaster papposa*, which we have always considered as the young of *Caprella linearis*, with which they agree in their general character; but the second segment of the pereion is not longer than the first and the superior antennæ are scarcely longer than the inferior; it is a remarkable fact that some of the specimens, being females, are furnished with the incubatory pouch. As these animals (of which we give figures as a vignette on the next page) are only one-tenth of an inch in length, we must either conclude that they are imperfectly-developed specimens of *C. linearis*, and that they are endowed with the capability of reproduction before they have attained to their adult form and dimensions; or that they are a species distinct in themselves, exhibiting the character of an imperfectly-developed specimen of *C. linearis*.

Moreover, it is singular that they should have been found in great abundance in this solitary instance, for we are not aware of any having been similarly taken in any other instance.

If they be young animals we must assume them to have been of a single brood; but if so, it is a curious feature in their history that the brood should remain associated until the females were old enough to carry ova, and that this latter circumstance should occur while the animals were still so small.

Since the above has been written, Mr. Norman has

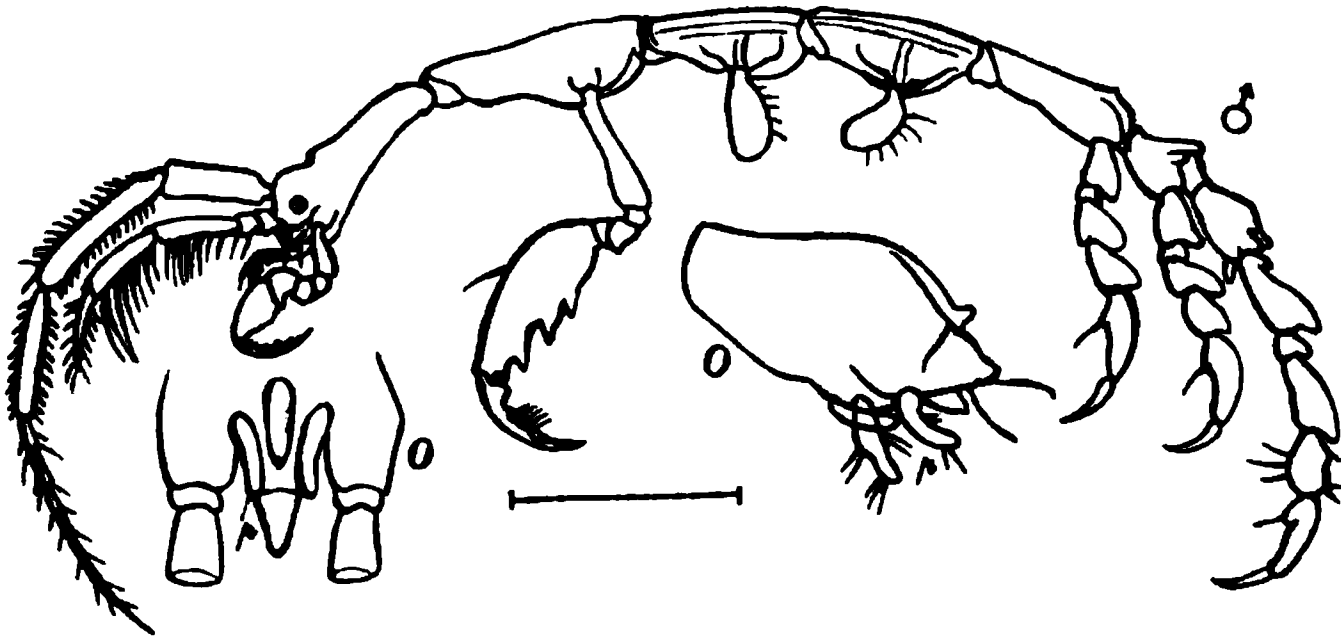
* Gosse's Rambles of a Naturalist in Devonshire.

sent us several specimens that resemble the male of this small variety. These vary in size, and we should not hesitate to pronounce them to be the young of *C. linearis*; amongst them there is not a single specimen furnished with the incubatory pouch, although some are larger than those taken by Mr. Gosse.



AMPHIPODA.
ABERRANTIA.

CAPRELLIDÆ.



CAPRELLA LOBATA.

Specific character. Body unarmed except by a few minute tubercles occasionally present, especially upon the dorsal surface of the three posterior segments of the pereion. First segment of the pereion long; second scarcely longer than the first. Second pair of gnathopoda having the propodos long-ovate; palm defined by one, and armed with two teeth, the anterior being less distinct than the posterior.

Length $\frac{3}{4}$ inch.

Squilla lobata.

MÜLLER, Zool. Dan. Prod. 197, No. 2359. O. FABR. Fauna Grönl. p. 248. SAMOUELLE, Ent. Comp. p. 106.

Caprella lobata.

GUERIN, Iconogr. R. An. Crust. pl. xxviii. fig. 2. KRÖYER, Voyage en Scand. pl. xxv. fig. 3a. STIMPSON, Nat. Hist. Invert. Grand Manan, p. 44. THOMPSON, Ann. Nat. Hist. xx. p. 244. SPENCE BATE, Cat. Amph. Crust. Brit. Mus. p. 354, pl. lv. fig. 3. Ann. Nat. Hist. 2 ser. xix. p. 151.

Squilla quadrilobata. MÜLLER, Zool. Dan. t. 114, fig. 11, 12.

Ægina longicornis. KRÖYER, Voy. en Scand. pl. xxvi. fig. 3.

Caprella lævis.

GOODSER, Edin. New Phil. Journ. xxxiii. p. 189, pl. iii. fig. 4. WHITE, Pop. Hist. Brit. Crust. p. 215. Hist. Brit. Crust. p. 60.

Caprella linearis.

LEACH, Edin. Enc. vii. p. 404?

IN this species the animal is generally smooth, but we have occasionally seen specimens which have a few minute tubercles on the back, those most important and

constant being on the last three segments of the body, and such are figured by Kröyer. The head is rounded in front, and occasionally surmounted by a minute tubercle. The first segment of the body, which is confluent with the head, is rather long. The second is rather longer, while the three succeeding are somewhat shorter, and subequal in length. The superior antennæ are not half the length of the animal. The inferior scarcely reach beyond the distal extremity of the second joint of the peduncle of the upper. The first pair of legs articulate with the body at the anterior extremity of the first segment of the body. The second pair of legs articulate with the body behind the middle of the second segment: the hand is long and oval, the palm being distinctly defined by a strong tooth, and armed also near the middle with two others, the anterior of which is frequently less distinctly apparent than the posterior. All the remaining parts bear a very near resemblance to those of *C. linearis*.

Dr. Leach describes this species (under the name of *C. linearis*) as being, when alive, of a brown colour, inclining to cinereous, beautifully spotted with rust colour.

All the specimens that we have examined of this species are certainly males, and we have a strong conviction that they are but fully-developed males of *C. linearis*, from the fact that the specimens which we have described as males of *Caprella linearis* only differ from those of *C. lobata* in having the first and second segments of the body shorter, these two segments being subject to vary in length, and probably increasing with age. Furthermore, we have never been able to determine the female of *C. lobata*.

C. lobata is, moreover, generally associated with *C. linearis*, and will probably be found to exist all round the

coasts of Europe. In Great Britain it has been obtained at Kames Bay, N. B., by Mr. Robertson; in the Moray Frith by Mr. Edward; at Cullercoats it was taken by the Rev. A. M. Norman, and we have taken it at Plymouth.

Specimens from the Frith of Forth are preserved in the British Museum collection.

The accompanying vignette represents a female *Caprella* carrying her offspring upon her back, as described at page 54.

AMPHIPODA.
ABERRANTIA

CAPRELLIDÆ.



CAPRELLA ACUTIFRONS.

Specific character. Cephalon in both sexes anteriorly surmounted by a strong tooth directed forwards. Second pair of gnathopoda having the propodus with the palm deeply waved, and defined by an obtuse angle armed with a spine; limbs very robust.

Length $\frac{3}{8}$ inch.

Caprella acutifrons.

LATREILLE in N. Dict. d'Hist. Nat. 2nd Edit. vi. p. 433 (1816), DESMAREST, Consid. sur Crust. p. 277. MILNE EDWARDS, Hist. des Crust. iii. p. 108. WHITE, Pop. Hist. Brit. Crust. p. 216. Cat. Brit. Crust. p. 60. SPENCER BATE, Cat. Amph. Crust. Brit. Mus. p. 356, pl. lvi. fig. 6. VAN BENEDEN, Recherches sur la Faune littorale de Belgique, p. 145, pl. xvi.^{es} fig. 9-11.

Cancer (Astacus) atomos?

PENNAUT, Brit. Zool. iv. pl. xiii. fig. 13, 2nd ed. 1812 (very bad). STEW. Elements, ii. p. 317.

Caprella Pennantia.

LEACH, Edin. Encyc. vii. p. 404. SPENCER BATE, Ann. Nat. Hist. 2 ser. xix. p. 151.

Caprella Pennantii.

JOHNSTON in Ann. Nat. Hist. viii. p. 670. R. Q. COUCH in Report Penzance, Nat. Hist. Soc. 1852, p. 97.

IN this species the male and female do not appear to differ very materially. The head is surmounted by an anteriorly-directed horizontal tooth, but the rest of the body is smooth. In the male the first segment of the body is scarcely longer than in the female, and the second segment is not much longer than in the female, nor is it longer than the third or fourth segments. The third and

fourth, which in the female carry the ovigerous plates, have, in the male, the lateral walls (coxæ) produced into lateral plates, which are produced anteriorly to a point. The superior pair of antennæ are about two-thirds the length of the animal, the flagellum is shorter than the peduncle, and each articulus is infero-distally produced, and furnished with cilia. The inferior antennæ are about the length of the peduncle of the superior, terminating in a short flagellum, which consists of a long and a short articulus. The first pair of legs are short, but the form of the hand resembles that of the second. The second pair of legs are longer than the first. In the female they articulate with the extreme anterior limits of the second segment, but in the male they articulate a little posteriorly. The hand, in the male, is ovate, tapering to the distal extremity; the palm is waved, and defined by a strong tooth, armed with a stiff spine. In the female the palm is less distinctly waved and defined. The three posterior pairs of legs are short and robust.

The only animal that we have seen alive was covered with numerous points or fine hairs. It was of a reddish colour, shaded off into green.

This species appears to be one of the least dispersed in the British seas, and our observations have consequently been the more restricted.

It was found by Dr. Leach on the Devonshire coast, and it has since been taken in Plymouth Sound by Mr. Boswarva. "Not uncommon among Corallines in Mount's Bay."—Mr. R. Q. Couch.

Van Beneden states, that it is found in great abundance on the shores of Belgium, in the middle of tufts of confervæ along with *Tanais*, upon the carapace of *Chelonia mydas*.

This species appears to have a near representative in different parts of the globe. It differs but little from *C. geometrica* of the United States, and is distinguishable in the thickness of the body only from *C. robusta* from Rio Janeiro. It closely resembles *C. nodosa* from the Mauritius, and also a species recently sent to us by Mr. Taylor, that we take to be identical with *C. geometrica*, and which he procured in great abundance from amongst the weeds at the bottom of an old yacht which had been lying undisturbed for about two years in the harbour of Hong Kong.

The vignette below represents a Gower Cockle Girl.

AMPHIPODA.
ABERRANTIA.

CAPRELLIDÆ.



CAPRELLA HYSTRIX.

Specific character. Tuberculated along the dorsal surface, the tubercles increasing posteriorly. Second pair of gnathopoda having the propodos ovate ; palm convex, defined by a blunt process surmounted by a spine.

Length $\frac{1}{8}$ inch.

Caprella Hystrix.

KRÖYER Nat. Hist. Tidssk. iv. 603. pl. viii. fig. 20-26. Voy. en Scand. pl. xxiv. fig. 1?

Caprella acuminifera.

MILNE EDWARDS, Hist. des Crust. t. iii. p. 107, pl. xxxiii. fig. 21. SPENCE BATE, Cat. Amph. Brit. Mus. p. 359, pl. lvi. fig. 11 (not of LATREILLE and DESMAREST).

THIS species is tuberculated throughout the entire length of the animal, the tubercles increasing in size towards the posterior extremity of the body. The head is slightly angulated on the crown. The first segment of the body is short ; the second is longer, and of the same length as the third, fourth, and fifth. The sixth and seventh are shorter. The superior antennæ are less than half the length of the animal ; the inferior are not longer than the peduncle of the superior. The first pair of legs are small ; the second articulate near the centre of the second segment of the body, but in the

female (figured above) they articulate quite at the anterior extremity. This is the only reliable distinction that we have been able to discover between the two sexes. The hand in this pair of legs is ovate, the palm convex, being defined by a process surmounted by a spine. The palm is emarginate near the posterior extremity, and waved a little anteriorly.

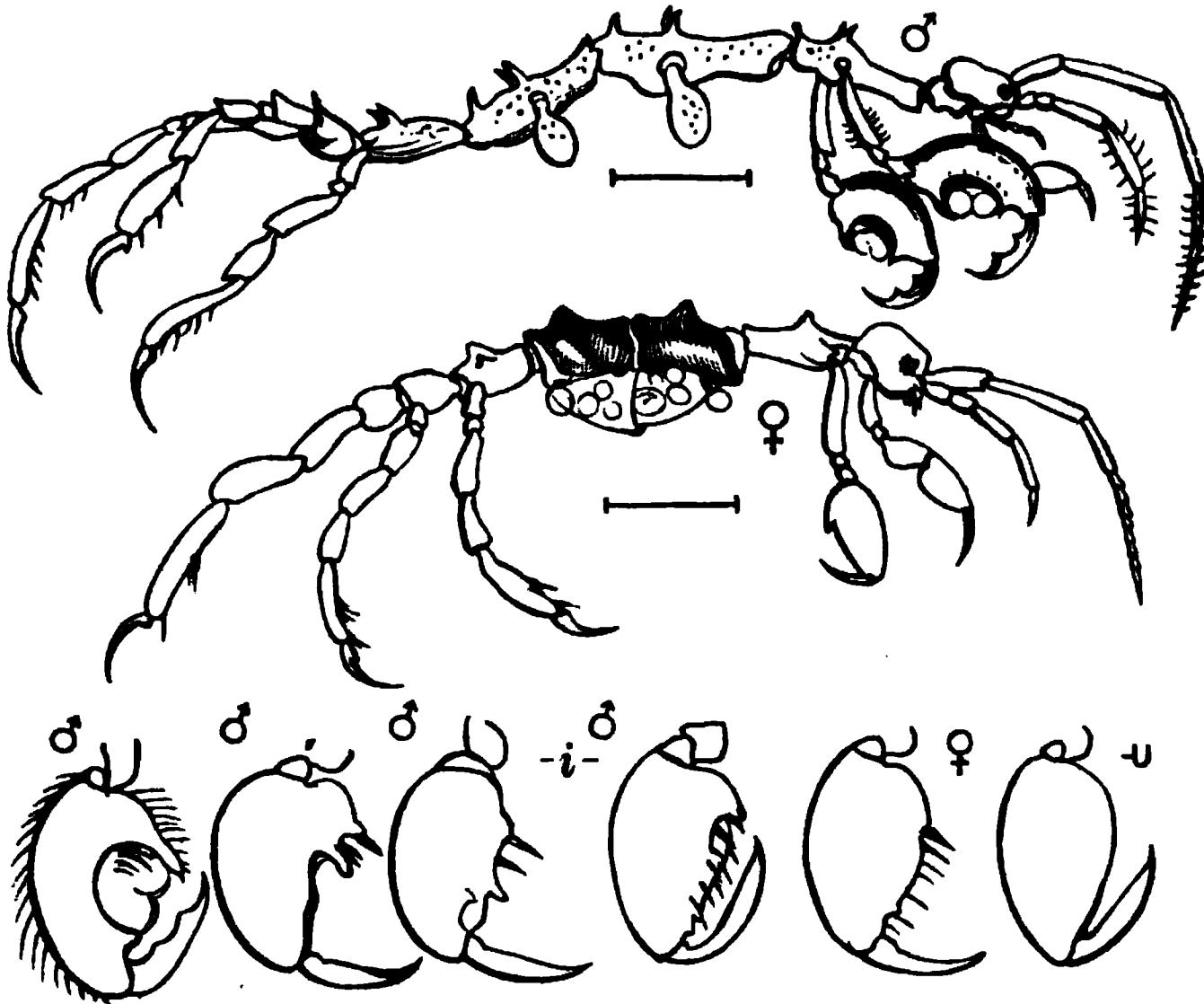
We consider this species to be identical with that figured by M. Milne Edwards in the place cited, as also, probably, with the *C. Hystrix* of Kröyer, although the description of the head given by the former author, "ovalaire, courte et arrondie en dessus," seems to have been derived from *C. acanthifera*, and his observation that the penultimate joint of the last three pairs of legs is narrow and without a tooth on the inner edge, disagrees with our species (although agreeing with Kröyer's details of the legs of *C. hystrix*). Unfortunately M. Milne Edwards is unable to clear up this difficulty, the specimen from which he drew his figure not having been preserved.

Considering the *C. acuminifera* of Latreille to be identical with *C. acanthifera* of Leach, we have been obliged to take up Kröyer's name for the present animal, although not quite agreeing with his description as above noticed.

We have received specimens of this species from Millport, sent to us by Mr. Robertson; from Northumberland, where it was found by the Rev. A. M. Norman, and we have taken it in the neighbourhood of Plymouth.

AMPHIPODA.
ABERRANTIA.

CAPRELLIDÆ.



CAPRELLA ACANTHIFERA.

(*Skull-headed Skeleton Shrimp.*)

Specific character. Cephalon posteriorly and dorsally vaulted. First segment of the pereion short; second, third, and fourth subequally long, surmounted by three large dorsal tubercles; fifth, sixth, and seventh segments short, each surmounted by two sublateral parallel tubercles. Second pair of gnathopoda having the propodos large in the male, rounded above and very concave below, the palm defined by a prominent tooth; in the female the palm is slightly convex and the dorsal tubercles are less prominent.

Length $\frac{8}{10}$ of an inch in the male, and $\frac{7}{10}$ in the female.

Puce de mer arpentuse. DE QUERONIC, Mém. Math. et Physiq. Acad. Sci. Paris, t. ix. p. 329, fig. A B.

Caprella acanthifera. LEACH, Edin. Ency. vii. p. 404 (not of Johnston and Couch). W. THOMPSON, Ann. Nat. Hist. xx. p. 245. WHITE, Cat. Brit. Crust. p. 60. Pop. Hist. Brit. Crust. p. 215.

Caprella calva. SPENCE BATE, Cat. Amph. Crust. Brit. Mus. p. 359, pl. lvi. fig. 11.

Caprella acuminifera. LATREILLE, in Nouv. Dict. d'Hist. Nat. 2nd Edit. vi. p. 433. DESMAREST, Consid. Crust. p. 277 (not of Johnston). SPENCE BATE, Ann. Nat. Hist. 2 ser. xix. p. 151.

THIS species may readily be detected from any other by the peculiarly vaulted or skull-like head, together with the tuberculated character of the body. The first segment of the body is short. The three next are longer than the first, equal to each other, and surmounted by three dorsal blunt teeth, or tubercles. The two anterior, immediately over the articulation of the second pair of legs, are sublateral and parallel. The third is central, and situated upon the posterior margin. The last three segments are short, and each is furnished with only two sublateral parallel tubercles, which are surmounted by numerous small, bead-like tubercles. The superior antennæ are not half the length of the animal. The inferior antennæ are not longer than the peduncle of the superior. The first pair of legs are small, the hand being ovate and the palm slightly convex and imperfectly defined. The second pair of legs articulate with the second segment of the body, posteriorly to the centre. They have the hand in the male very large, rounded on the back, and hollow below (in some specimens we have seen inflated membranous sacs filling the palm), being defined posteriorly by a sharp tooth, and armed anteriorly with a small point that marks the position where the lateral walls of the palm unite together anteriorly. The finger is much curved, and armed with two obtuse teeth upon the inner margin. The three posterior pairs of legs are of equal length, and adapted for prehensile use.

In the female the tubercles upon the back are less conspicuous than in the male, and the second pair of legs have the hand smaller, of an oval form, the palm being slightly convex, defined by a small process, armed with

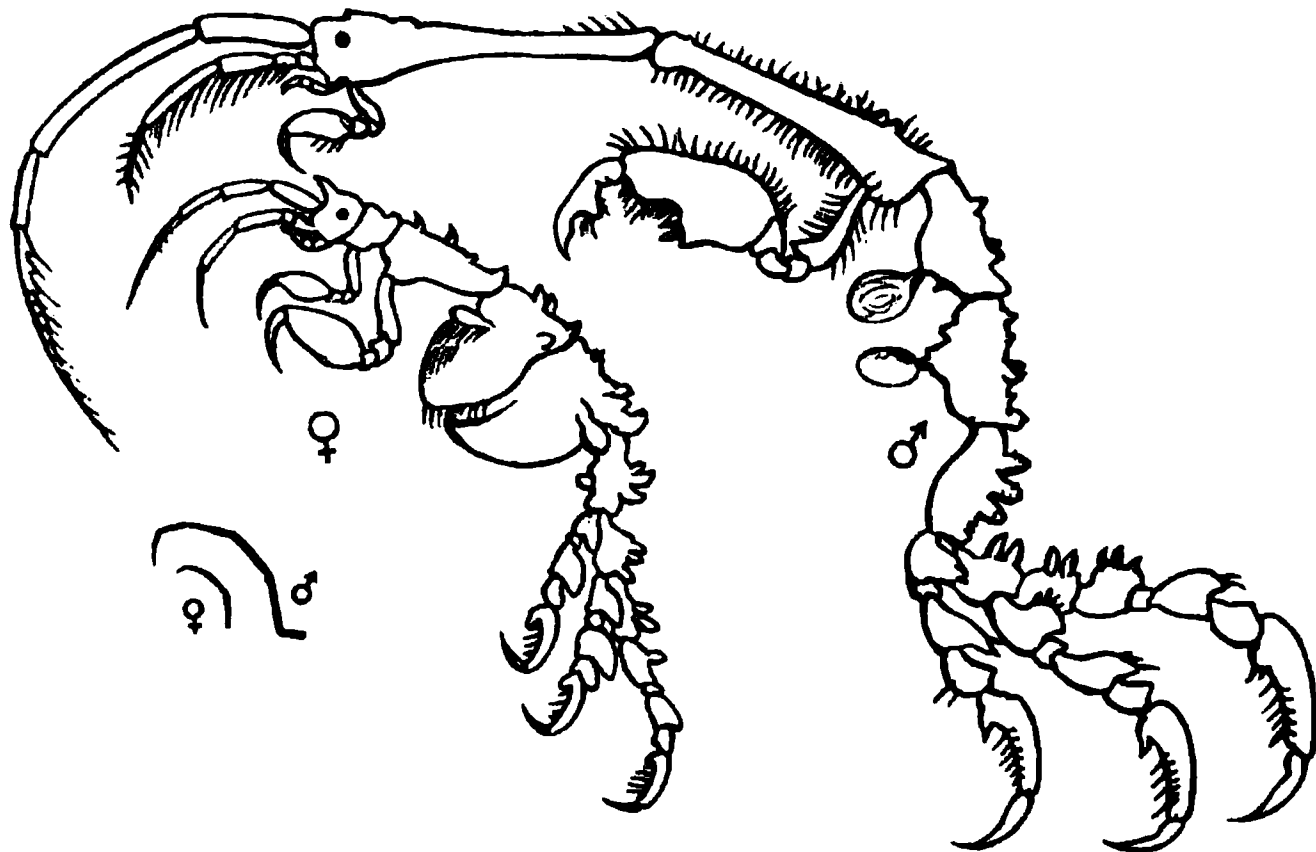
one or two short, stiff spines. In the young the hand is nearly of the same form as that of the female, but the palm is only imperfectly, if at all, defined. Between this last and that of the male above described, we represent in our plate four figures, exhibiting various degrees of development in different individuals of the same species.*

This species was first excellently figured by M. De Queronic, as above referred to, from a specimen found amongst the branches of a *Fucus*, covered with coral-lines, in the Bay of Loc Mariaker, on the coast of Brittany. It has been taken at Plymouth by Mr. Barlee on Drake's Island at low water spring-tides, as well as dredged by ourselves in Plymouth Sound. Mr. Edward has sent it to us from Banff, the Rev. A. M. Norman from Northumberland, and we have received it from Mr. Robertson from Millport. Specimens are also in the Belfast Museum Collection, obtained by the late W. Thompson, Esq., who found it amongst *Corallina officinalis*, in shallow pools between tide-marks, at Spring-Vale, County Down, in July, 1846. It is also in the Bell Collection at Oxford, taken by the Rev. J. Gordon in the Frith of Forth.

* In the British Museum is preserved a series of this species, to one of the individuals of which the specific name *C. acanthifera* is attached in the handwriting of Dr. Leach, whose description,—“Back, especially the hinder part, spiny; inner edge of the second pair of hands lunate-excavated,”—is so short and insufficient as to have led Mr. Spence Bate into the idea that the following species was the true *C. acanthifera*, and the present one, consequently, undescribed. Dr. Leach found his species not uncommon on the Devonshire coast, and forwarded specimens to Latreille with the MS. name of *C. acuminifera*, which was adopted by Latreille and Desmarest, the former of whose descriptions is evidently taken from a male of *C. acanthifera*. Both these names have been misapplied by Johnston and R. Q. Couch to the cornuted females of the following species.

AMPHIPODA.
ABERRANTIA.

CAPRELLIDÆ.



CAPRELLA TUBERCULATA.

Specific character. Male.—Cephalon not lobed. First two segments of the pereion long and smooth; the five last shorter and dorsally tuberculated. Second pair of gnathopoda having the propodos long, pubescent; palm defined by a strong tooth.

Length $\frac{1}{2}$ inch.

Female.—Cephalon surmounted by a tooth, and the pereion dorsally tuberculated. Second pair of gnathopoda defined by a small tooth.

Length $\frac{1}{4}$ inch.

Caprella tuberculata.

GUÉRIN, Icon. R. An. Crust. pl. xxviii. fig. 1.
GOODSER, Edin. New Phil. Journ. xxxiii. p.
188, pl. iii. fig. 6. W. THOMPSON, Ann.
Nat. Hist. xx. p. 244. SPENCE BATE, Ann.
Nat. Hist. 2 ser. xix. p. 151. WHITE,
Cat. Brit. Crust. p. 60. Pop. Hist. Brit.
Crust. p. 215, pl. xi. fig. 5.

Fem. Caprella acuminifera. JOHNSTON, Mag. Nat. Hist. vi. p. 40. fig. 7a
(not of Latreille and Desmarest).

Fem. Caprella acanthifera. JOHNSTON, Mag. Nat. Hist. viii. p. 671, fig. 70.
R. Q. COUCH, Rep. Penzance, Nat. Hist. Soc.
1852, p. 96 (not of Leach). SPENCE BATE,
Cat. Amph. Brit. Mus. p. 360. pl. lvii.
fig. 2.

THE males are much larger than the females. The head, instead of being armed with a tooth, is furnished with a minute tubercle. The first two segments of the body are very long, and smooth; the second somewhat hirsute. The third, fourth, and fifth are shorter than the preceding, and subequal in length; these are all tuberculated upon the dorsal surface, as are also the sixth and seventh segments. The tubercles, which are very insignificant upon the third segment, increase in size posteriorly, and are very conspicuous upon the three last segments. The superior antennæ reach but little beyond the first segment of the body. The first joint of the peduncle is about the same length as the third, but the second joint is much longer than either. The inferior antennæ reach to the extremity of the second joint of the peduncle of the superior. The first pair of legs are very small, and situated quite at the anterior extremity of the first segment of the body, therefore appear to be attached to the head. The second pair of legs articulate with the second segment of the body at its posterior extremity. The hand is nearly as long as the second segment, and hirsute upon the upper margin and palm. The palm lies nearly parallel with the upper margin for more than half the length of the hand, where it is defined by a strong tooth or process. The finger is furnished upon the inner margin with an obtuse tooth or pointed tubercle. The last three pairs of legs are short and robust.

In the female the head is surmounted by a strong tooth, directed upwards and forwards. The first segment of the body is short; the second much longer, and tuberculated; the five remaining segments are tuberculated, the tubercles increasing in size posteriorly. The second pair of legs articulate near the anterior extremity of the

second segment of the body. The hand is ovate, the palm straight, and defined by a small denticle.

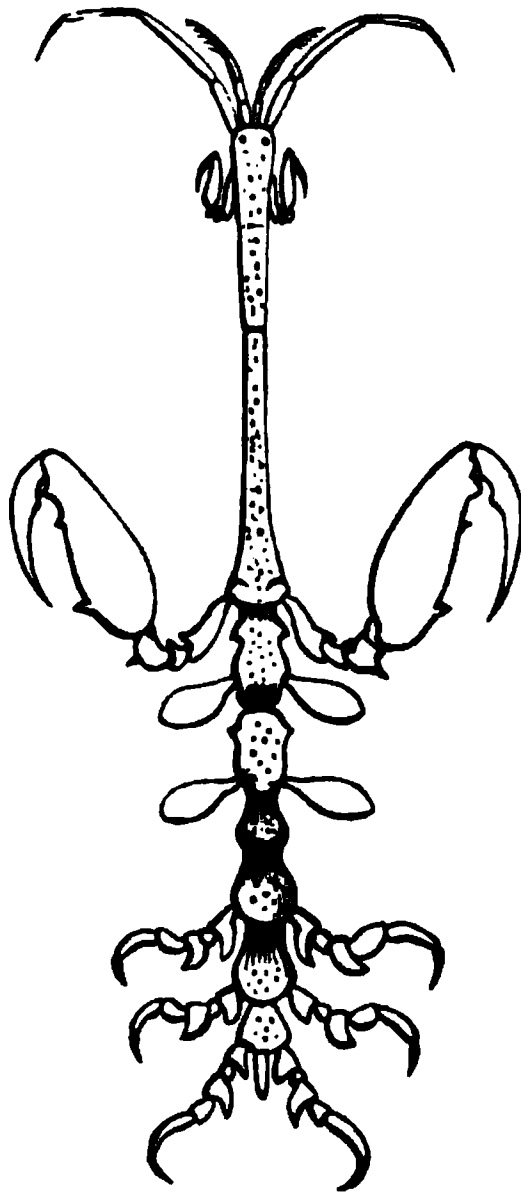
We have received this species from Guernsey, where it was taken by the Rev. A. M. Norman, and from Millport, N.B., where it was captured by Mr. Robertson. A considerable number were found by Mr. T. L. Couch in the crevices of a crab-pot buoy thrown on the coast at Polperro during a heavy gale in 1854, and Mr. R. Q. Couch obtained the female at Mount's Bay, in Gwavas Lake, and off St. Michael's Mount, among confervæ. Specimens from the Frith of Forth are contained in the British Museum Collection.

In the male of this species the form of the palm is very liable to vary from the character as exhibited in the female to that of the male, as above described.

It is not hastily that we have come to the conclusion that the two animals represented above are but sexes of one species. The animals are from the same locality, and their distinctive characters do not appear to have a higher value than such as indicate the sexes of one and the same species. We have been induced to identify it with Goodsir's *C. tuberculata* by the pointed tooth upon the head, rather than to associate the latter with *C. hystrix* (*acuminifera*), which also may possibly be but a variety of this same species.

AMPHIPODA.
ABERRANTIA.

CAPRELLIDÆ.



CAPRELLA ÆQUILIBRA.

Specific character. *Male*.—Body smooth. First and second segments of pereion very long, equal to half the length of the animal. Second pair of gnathopoda articularly at the posterior extremity of the second segment; propodos long-ovate; palm subparallel with the upper margin, armed anteriorly with a large triangular tooth or process, and a small denticle immediately posterior to the process.

Length $\frac{3}{4}$ inch.

- Caprella æquilibra.* SPENCE BATE, Cat. Amph. Crust. Brit. Mus. p. 362,
pl. lvii. fig. 5.
- Caprella equilibra.* SAY, Journ. Acad. Philad. i. p. 391.
- Caprella Januarii.* KRÖYER, Nat. Tidssk. iv. p. 499, pl. vi. fig. 14-20.
Voy. en Scand. pl. vi. fig. 15. DANA, U. S. Explor.
Exped. p. 819, pl. lv. fig. 2.

THE body of this animal is smooth. The head is round and unarmed. The first segment of the body is very long, cylindrical, and slender. The second segment is as long as the first, and resembles it, except that as the first gradually lessens in diameter posteriorly, the second as gradually increases posteriorly, and is armed inferiorly, in the ventral median line, with a long straight tooth, between the articulations of the second pair of arms. These two segments, with the head, occupy half the length of the animal. The remaining five segments of the body are, therefore, shorter than in the majority of the species of this genus. The superior antennæ are not half the length of the animal; the first joint of the peduncle is longer than the head; the second more than twice the length of the first; the third about half the length of the second, and does not taper at the extremity: the flagellum is about half the length of the third joint of the peduncle, and half the diameter at the base. The inferior antennæ are not half the length of the superior. The first pair of legs are very small, and situated at the extreme anterior limit of the first segment of the body, therefore close to the head. The second pair of legs articulate with the second segment near the posterior extremity, consequently are situated about the centre of the animal, a circumstance from which we presume that Say gave the animal its specific name; the hand is long, and somewhat oval in its general form, but the palm, which is defined by a small tooth, is straight, running nearly parallel with the upper margin, and occupying about two-thirds the entire length of the hand, which is more than half the length of the second segment of the body; the palm is armed at the anterior extremity with an acute tubercle or short tooth and a small denticle (which,

Say says, is not constant), situated immediately posterior to the process. The last three pairs of legs are very short.

Having had the opportunity of comparing our British specimens with that presented to the British Museum by Mr. Say, we are enabled to assert their identity, and we are not able to detect any character by which this species differs from *C. Januarii*, as described by Dana and Kröyer. We have also seen specimens from Hong-kong, and are unable, by the closest observation, to discover any difference between them.

The geographical range of this species is, therefore, very great. In our own country we took it first amongst weeds attached to one of the buoys in Plymouth Sound. It has since been sent to us from Seaham by the Rev. A. M. Norman, who has also taken it at Cullercoats. But Kröyer's type came from Rio Janeiro, while Dana's specimens were procured from an anchor in from ten to twelve fathoms of water, also at Rio Janeiro. Mr. Harington has sent specimens to the British Museum, which he procured at Hong Kong, and Say found his specimens "very common in the bay of Charleston, particularly at Sullivan's Island, on the two species of *Gorgonia*, so common in the salt-water creeks of the southern coast."

AMPHIPODA.
ABERRANTIA.

CAPRELLIDÆ.

CAPRELLA SPINULATA.

Specific character. "Long and slender; head deeper than the other annulations. Head without a spine, but all the other annulations with one or more dorsal spines."

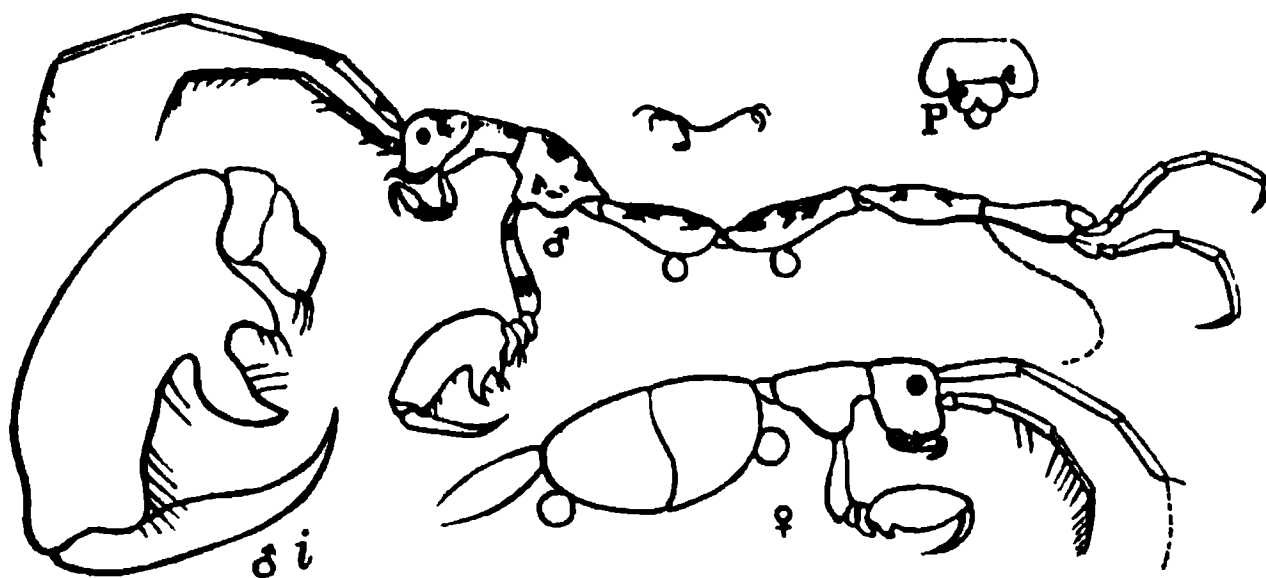
Caprella spinulata. R. Q. Couch, in Report Penzance Nat. Hist. Soc. 1852, p. 98.

"LONG and slender. The head is larger than the next articulation, and without a spine; the occipital articulation with a spine near its posterior margin; and there is one on the next ring above the branchiæ. There are two on the third, one above the branchiæ, one near its posterior margin, and one in the centre of each of the others. Superior antennæ as long as the body; basal joint small; the second about four times as long as wide; the third long and slender, and slightly enlarged towards its distal extremity, the last multi-articulate and ciliated. The inferior antennæ much smaller than the others. At the lower part of the head two pedi-palpi, small and bifid at their extremities. The hand very large; moveable joint long, slender, and hooked, and at its point, when bent, touches a spine on the hand."

Taken by Mr. R. Q. Couch (whose recent death we have to deplore) in a pool among confervæ, Lariggan Rocks, Mount's Bay, Cornwall, from whose description in the work above quoted we make this extract, regretting that we are unable to give a representation of this species.

AMPHIPODA.
ABERRANTIA.

CAPRELLIDÆ.



CAPRELLA TYPICA.

Specific character. Body entirely smooth, and destitute of spines in both sexes. Second segment of the body short and deep. Second pair of gnathopoda with the hand large and curved, armed at the base of the palm (defined by a strong obtuse tooth) with a robust recurved spine. Antennæ moderately long and slender; hind legs slender, with the hand simple.

Length $\frac{1}{4}$ inch.

Podalirius typicus. KRÖYER, Nat. Tidsk. 2nd Ser. i. p. 288. Voy. en Scand. pl. xxv. fig. 1 a—l. SPENCER BATE, Cat. Amph. Brit. Mus. p. 354, pl. lvi. fig. 2.

THIS species has been formed by Krøyer into a separate genus, named *Podalirius*, in consequence of the very rudimental condition of the abdominal portion, of which none of the appendages are developed (Fig. P). It resembles *C. linearis*, but is more robust, the head and second segment of the body being deeper and shorter than in that species. The antennæ are slender: the superior in the male are nearly twice as long as the inferior, the peduncle of which scarcely reaches to the extremity of the second joint of the superior; the flagellum of the latter being composed of very few articuli. In the female the peduncle of the lower antennæ apparently extends as far as the extremity of the peduncle of the superior, which is, however, mutilated in our unique

specimen of this sex. The males are also at once distinguished by the peculiar form of the hand of the second pair of legs, which is of large size, strongly curved on its fore margin, whilst the posterior, or palm, is excavated; its distal extremity broadly but obliquely truncate, whilst its base is armed with an obtuse point, antagonizing with the tip of the finger, followed by a strong bent and recurved tooth. The first pair of legs are small, and the hand oblong-ovate; this is also the form of the hands of the second pair of legs in the female, but the base of the palm is defined by a conical point near to the base of the joint.

Our specimens (like those of Kröyer) have also lost the antepenultimate pair of legs, but in the two posterior pairs the joints are slender, naked, and destitute of spines or points, so as to appear quite simple.

Several specimens of this species, collected by the Rev. J. Gordon in the Frith of Forth, exist in the Bell Collection of Crustacea, recently presented to the University Museum of Oxford by Professor Westwood. They were obtained upon a shell brought up on a had-dock line on the 18th September, 1855.

Fam. III.—CYAMIDÆ.

Body flat. Cephalon cylindrical, tapering, anchylosed with the first segment of the pereion. The latter broad, depressed, with the segments laterally wide apart. Pleon rudimentary. Eyes posterior to the superior antennæ, of which the flagellum is indistinctly articulated. Inferior antennæ minute, inserted between the upper pair and the labrum. Gnathopoda subchelate. Pereiopoda flat, broad, and furnished with strongly-hooked dactyla, wanting to the third and fourth segments of the body, which are furnished with elongated branchiæ.

This family consists of a single genus, the species of which are parasitic upon the cetaceous animals. They are of moderate size, and are able, by means of the strong hooks with which their legs are terminated, to affix themselves firmly to their prey. The head is small, oblong, and cylindrical, soldered to the first segment of the body, which is dilated at its sides, giving this part of the animal a pear-shaped appearance. The antennæ are affixed to the anterior and superior extremity of the head. The upper pair are of moderate size; the peduncle composed of three nearly equal-sized joints, followed by a small, indistinctly-articulated flagellum. The inferior pair are very small, and terminate in a small conical, apparently uni-articulate flagellum. Immediately beneath these latter appendages is a small tubercle, which is homologous with the olfactory organ of the normal Amphipoda. The mouth is small, and placed at the infero-anterior extremity of the head: it consists, according to Savigny, of a

labrum, rounded at the sides, but emarginate in front; a pair of mandibles, bifid and denticulated at the tip, but destitute of a palpus; a first pair of maxillæ, composed of a single lobe; a second pair of maxillæ, much smaller than and inserted between the first pair, upon a common base, and each bearing a very minute two-pointed palpus; a labium, composed of two outer lobes and two inner minute ones (representing the four maxillæ), and a large maxillary outer labium, furnished with a pair of five-jointed palpi.

Independent of the first articulation of the body, soldered to the head, the animal consists of six flattened segments, of which the middle ones are the broadest. They are separated widely from each other at the sides, and the last is terminated by a minute rudimental tail. The segment attached to the head supports on its underside a pair of small legs, generally folded beneath the body, composed of four joints, terminated by a subcheli-form hand and a slender, curved finger. The following segment of the body bears a large and powerful pair of legs, although they possess one joint fewer than the hinder pairs. The hand is broad and flattened, and the finger curved and acute at the tip. The third and fourth segments of the body are destitute of legs, but their place is supplied by a pair of elongated, cylindrical, branchial appendages, in some species being as long as the legs themselves, generally turned over the back of the animal. Sometimes these are simple, but in other cases they are double, and at their base in the male is to be observed one or two small corneous points. In the female these two segments of the body bear two large ovigerous scales, affixed at the base of the four branchial appendages. The fifth, sixth, and seventh segments of the body respectively bear a pair of legs nearly similar in

shape and size to those of the second segment, but composed of five joints, the coxæ being soldered to the segments to which they are attached. The tail is very minute and rudimental: on its underside in the male are perceived two pairs of slender, deflexed, horny appendages; each of the two preceding segments being armed on the ventral surface with a pair of strong spines. In the female the antepenultimate segment of the body is furnished on its under-surface with two small transverse valves, uniting into a tubercle, which closes the orifice of the generative organs.

The analogy which these animals exhibit with the *Pediculi* among hexapod insects, and with *Pycnogonum* amongst the *Arachnida*, merits attention.

AMPHIPODA.
ABERRANTIA.

CYAMIDÆ.

Genus—CYAMUS.

- Cyamus.* LAMARCK, Syst. d. Anim. sans Vert. p. 166. LATREILLE, Hist. Nat. Crust., &c., vi. p. 328. DESMAREST, Cons. Crust. p. 279.
Larunda. LEACH, Trans. Linn. Soc. xi. p. 363. SAMOUELLE, Ent. Comp. p. 106.
Panope. LEACH, Edin. Encyc. vii. p. 404.

Generic character. Head and first segment of the body fused into a pear-shaped mass. Eyes small and vertical. Segments of the pereion with the sides horizontally dilated; the legs attached to the postero-lateral margins; five pairs of strongly subcheliform legs, wanting in the third and fourth segments, which are furnished with two pairs of branchial appendages, long and filiform. Pleon rudimental.

THESE animals affix themselves by means of their strong legs upon the rough portions of the bodies of cetaceous animals upon which they feed; the different species appear to affect particular portions of the bodies of these animals, some being found massed together upon the head, others are more erratic, or affix themselves to the fins, organs of generation and folds of the flesh. The males are larger than the females, upon which they affix themselves by means of the strong hooks of their feet as do the *Gammari*. The young remain for a considerable time attached to the female parent, nestling in the ovigerous pouch or rambling over her body. Their interior structure, as observed by Treviranus and Roussel de Vauzeme, closely approaches that of the *Isopoda*, the nervous system consisting of eight bilobed ganglions exclusive of the supra-œsophageal, each segment of the body being provided with a ganglion.

These creatures crawl but slowly, digging the hooks of their feet into the skin of the whale to the base of the claws, whence it is difficult to detach them by force, without cutting through the epidermis, when they are freed; it is also dangerous to attempt their removal, as their strong claws easily penetrate the fingers, and cause considerable pain. Their branchiæ are brought together on the back, and directed forwards, except in *E. gracilis*, which carries them in the opposite direction. When detached, and placed in sea-water, they are unable to swim, neither their branchiæ nor limbs enabling them to perform such an operation. When a whale is hoisted on board-ship, the Cyami attached to it extend their branchiæ, agitate their antennæ and hooked legs, as if desirous to seize something else. If the branchiæ are cut, the animals do not appear to be affected, but when the antennæ are similarly treated, the animals move about irregularly, from side to side and backwards, as if drunk. When injured, the branchiæ are never renewed; but if the legs are broken off at the base, new limbs are produced; but this is not the case if only a portion of the leg be injured: hence it is not unusual to meet with Cyami having one or more legs of smaller size than the rest.

M. Roussel did not observe any species of Cyamus on the dolphin, cachalot, or "baleine à ailerons." He states that it is generally believed by the fishermen that the albatrosses, which abound about the fishing stations, pick the Cyami off the bodies of the whales, but he had never found any of these crustacea in the stomachs of such specimens of these birds as he had dissected.

The structure of the mouth and intestinal canal of the Cyamus sufficiently prove it to be a gnawing, and not a suctorial, animal. Indeed, on opening its alimentary

canal small portions of the skin of the whale are found in it, and on removing the *Cyamus* from the whale, the epidermis, whence it is taken, is found to have been gnawed off.

The eggs of the *Cyami* are spherical, agglomerated, and of a yellowish-white colour: they are deposited in the ventral pouch, which is formed of thin membranous plates, ciliated along the margin, and here the young are hatched and carried until they are fully developed. Whilst the eggs remain in the incubatory pouch, the female detaches herself from her companions, rejoining them when she had got rid of her young brood. The young ones are complete in all their parts; the head, however, is proportionally of an enlarged size, the branchiæ globular, the anterior pair of legs not much smaller than the following, and the antennæ short. There appears, according to M. Roussel de Vauzeme, considerable difference in the treatment of the young brood by their parents. The females of *C. ovalis* arrange themselves side by side on the tubercles of the head of the whale, covering their young with their bodies, which form strong shields for their protection. In *C. gracilis*, on the contrary, the females and males, as well as young, are mixed together, whilst the young of *C. erraticus* are found isolated and fixed on the different parts of the body where they had been left by their parents; but in accordance with their future mode of life, M. Roussel gives a curious instance of the effect of the distinction of habits in the different species of this genus: in answer to an inquiry by Messrs. Audouin and Milne Edwards, as to whether *Cyamis gracilis* might not be the young state of *C. ovalis*, M. Roussel relied on the different habits and colour, as well as the particular form of the

body, whilst out of several hundred Cyami preserved in the collections at the Jardin des Plants he was only able to detect a single individual of *C. erraticus*, the mode of life of that species not rendering it so apparent to the collector as the species which associate together in vast numbers on prominent parts of the body.

From the further observations, both of Martens and Roussel de Vauzeme, it would appear that the violent storms of the winter season are very destructive to the Cyami, many of the parts of the whales generally infested by them being then free; those which survive being feeble and discoloured. He only observed *C. erraticus* to preserve its rosy tint, but its numbers were also diminished.

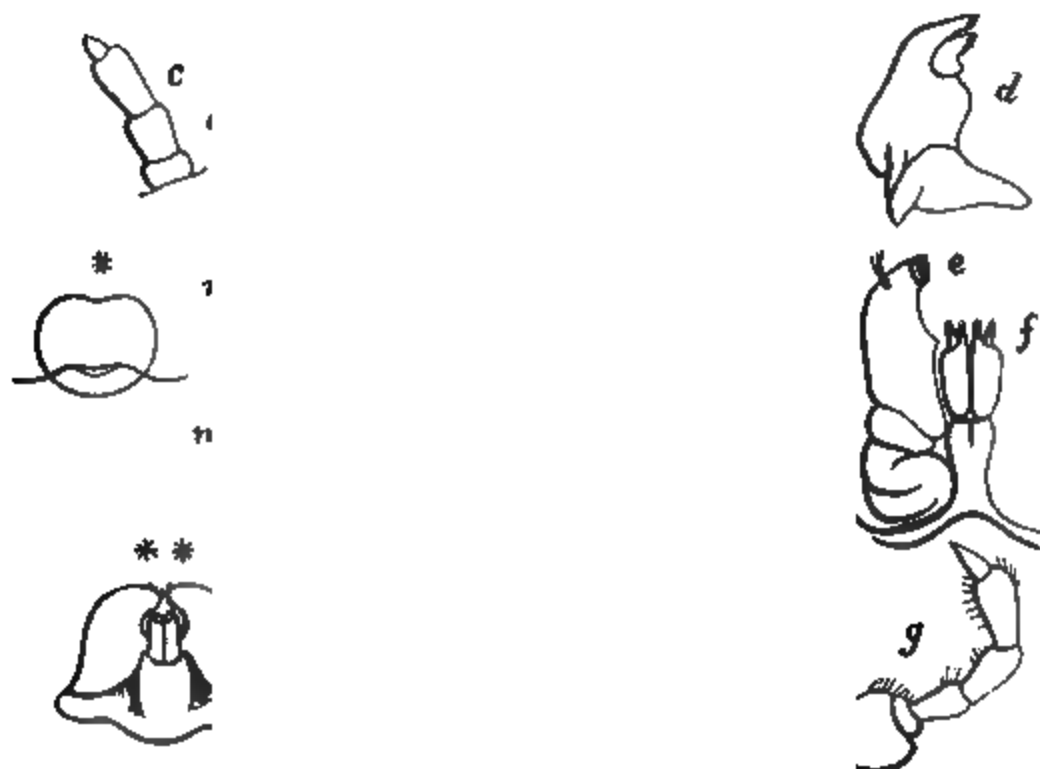
The relations of the Cyami with other Edriophthalmous Crustacea are very interesting. Placed by Linnæus, Pallas, and Müller amongst the *Onisci*, and arranged by Fabricius with the *Aselli* and *Cymothoe*, their relationship with the order *Isopoda* was indicated; and M. Roussel de Vauzeme, the author of an elaborate memoir on the genus in the "Annales des Sciences Naturelles" (2^e Sér. vol. i.), maintained their nearer approach to the *Isopods* than to any other Crustacea. Latreille, at first, placed the genus with the *Gammari*, in the order *Amphipoda*, but he subsequently united it with *Caprella*, to form the distinct order *Læmodipoda*; nor can we doubt (notwithstanding the objection of M. Roussel, founded on the variations in the mode of insertion of what he terms the fore legs) that this is the legitimate position of the genus; in fact, *Caprella* is but a laterally compressed *Cyamus*, and but little imagination is required to convert the former into an excessively attenuated *Cyamus*, so perfectly similar is the disposition of the segments of the body and limbs in both animals.

Savigny (as Fabricius had, indeed, previously done) pointed out a supposed affinity of *Cyamus* with *Pycnogonum*; and Strauss, having their parasitic habits in view, proposed to unite them with *Nymphon*, *Cecrops*, *Pycnogonum*, *Dichelestion*, &c., into a most heterogeneous group under the name of *Crustacea Parasita*.

AMPHIPODA.
ABERRANTIA.

CYAMIDÆ.

2



CYAMUS CETI.

The Whale Louse.

Specific character. Body depressed, elliptical, segments gaping at the sides (male narrower?). Third and fourth segments of the body with one long branchia on each side; armed at the base with two short appendages; second pair of hands armed beneath with two obtuse teeth, between which is a lunate incision.

Length nearly half an inch.

Pediculus Ceti.

MARTENS, Voy. Spitzbergen, viii. tab. ix. f d (1671).

LINNÆUS, Fauna Suecica, p. 499, No. 2056 (*Oniscus C.*). Syst. Nat. ii. p. 1060. SEBA, Thesaurus, t. i. pl. xc. fig. 5. PALLAS, Spicilegia Zool. fasc. 9, pl. iv. fig. 14, A B C. DE GEER, Mém. t. vii. pl. xlii. figs. 6, 7 (*Squille de la Baleine*). FABRICIUS, Ent. Syst. Suppl. p. 570 (*Pycnogonum C.*). LAMARCK, Syst. Ann. s. Vertèbr. p. 166 (*Cyamus C.*). MÜLLER, Zool. Dan. iii. pl. cxix. figs. 13-17

- Bosc. Hist. Crust. ii. pl. xvi. fig. 2. SAVIGNY, Mem. i. pl. v. LATREILLE, Hist. n. Crust. &c. vi. p. 331, pl. lii. fig. 4. Genera Ins. t. i. pp. 60, 176. DESMAREST, Cons. Crust. p. 280, pl. xlv. fig. 4. WHITE, Pop. Hist. Brit. Crust. p. 219, pl. xi. fig. 6. Cat. Brit. Crust. p. 62. SPENCE BATE, Cat. Amph. Brit. Mus. p. 366, pl. lviii. fig. 2. Ann. Nat. Hist. Feb. 7, 1857. LEACH, Edinb. Enc. vii. p. 404 (*Panope Ceti*). Trans. Linn. Soc. xi. p. 364 (*Larunda C.*). Suppl. Enc. Brit. i. p. 426, pl. xxi. SAMOUELLE, Ent. Comp. p. 106. M. EDWARDS, Hist. d. Crust. iii. p. 113. TREVIRANUS Verm. Schrift, ii. p. 1. Die Wallfischlaus, pl. i.
- Cyamus erraticus*. ROUSSEL DE VAUZEME, Ann. Sc. Nat. 2nd Ser. t. i. p. 259, pl. viii. fig. 22, 23. MILNE EDWARDS, Hist. N. Crust. iii. p. 113. GOSSE, Mar. Zool. i. p. 131 (not of Spence Bate, Cat. Amph. Brit. Mus. p. 368).

ALTHOUGH the early descriptions of the whale louse, of which, until recently, it was supposed that there was but a single species, are vague, the figures and locality sufficiently indicate that the creature, so beautifully figured by Savigny, in the first volume of his "Mémoires," and which is identical with the one represented in the above woodcut, was the species intended by Linnæus, De Geer, &c., the early representations of which exhibit only a single linear appendage attached on each side of the third and fourth segments of the body. We presume likewise, and are confirmed herein by M. Milne Edwards, that the *C. erraticus* of M. Roussel de Vauzeme is intended for the same species; his figure probably, from its narrower size, representing a male. The fact of several distinct species having been found to infest the whale, was doubtless the reason which induced the last-named observer to sink the specific name *Ceti* as of generic extent; but this principle is at variance with the rules of the best zoological nomenclaturists. By some oversight, Mr. Spence Bate, in his work on the Amphipoda (pp. 366, 368), has given *C. ceti* and *erraticus* as distinct species, referring, under

the former, to M. Milne Edwards, who, however, rejects the Linnean specific name *Ceti*. The animal represented by the former (Plate 58, fig. 2) from Talcahuna, in the Paris Museum, appears to be a male, being much more slender than the specimens represented by Savigny, and in our woodcut. The head is oval, its hinder portion being connate with the first segment of the body, of which the central portion is much shortened, the sides swelling into rounded lobes. The upper antennæ (*b*) are about twice the length of the head; the first, second, and third joints of nearly equal length; the first being the thickest and somewhat triquetrous, the terminal joint is minute and conical. The lower antennæ (*c*) are very minute and slender, not being more than one-third of the length of the basal joint of the superior, with four joints, the third being the longest, and the fourth very minute. The upper lip (*), copied from Savigny, is rounded at the base and slightly emarginate in the middle of its fore margin, whilst the tongue (**) is somewhat four-lobed, or rather it is deeply incised in the middle of its fore margin, and is furnished in the centre with a narrow bipartite projection, shorter than the lateral lobes. The mandibles (*d*) are somewhat triangular, destitute of a palpiform appendage, but furnished with a separate denticulated tooth below the extremity, which is similar in character: the first and second maxillæ are affixed on the same plane (as in the *Myriapoda*, although not soldered into one piece as in that order): the first pair (*e*) are large and flattened, apparently three-jointed and destitute of palpi, the terminal joint being large, rounded at the outside of its extremity, with several hairs forming a brush in the middle of the convex side; the second pair of maxillæ (*f*) are minute, and apparently three-jointed, the second and third joints being very minute; they are

affixed upon a common, elongated basal piece, inserted between the basal joints of the first pair, and the mouth is closed below by a transverse piece (fig. *g*), emarginate in its fore margin, which Savigny terms a “*lèvre auxiliaire sans lobes*,” but which we regard as the ventral surface of the segment that carries the pair of foot-jaws (which are attached at its sides); these are five-jointed, the fourth being the largest.

The first segment of the body is small, with the front part rounded on its upper edge, its lower being dilated in the middle into an angle.

The second segment is much longer than either of the two following, its fore margin is nearly straight, having a very minute rounded prominence towards each of its lateral anterior angles; it is deeply channeled across its centre. The legs attached to this segment are very large and broad, the second joint strongly angulated on its upper edge, the small third joint rounded and prominent on its lower edge, and the fourth joint with a moderate semi-lunate impression on its lower edge. The third and fourth segments of the body are very short, the fourth having its sides produced at the posterior lateral angles, whilst its hinder margin is emarginate on each side. The fifth, sixth, and seventh segments are each as long as the second, but gradually narrowed, their fore and hind margins are sinuated, leaving spaces between the joints. The legs attached to these three segments are nearly uniform in size, large and broad, with the fourth joint somewhat conical, having the upper edge rounded; the terminal joint in all the legs is very acute, curved, and as long as the preceding joint, thus giving the animal strong powers of prehension. The tail is very minute and rudimental. The full-grown female has the body wider than the male, and has the third and

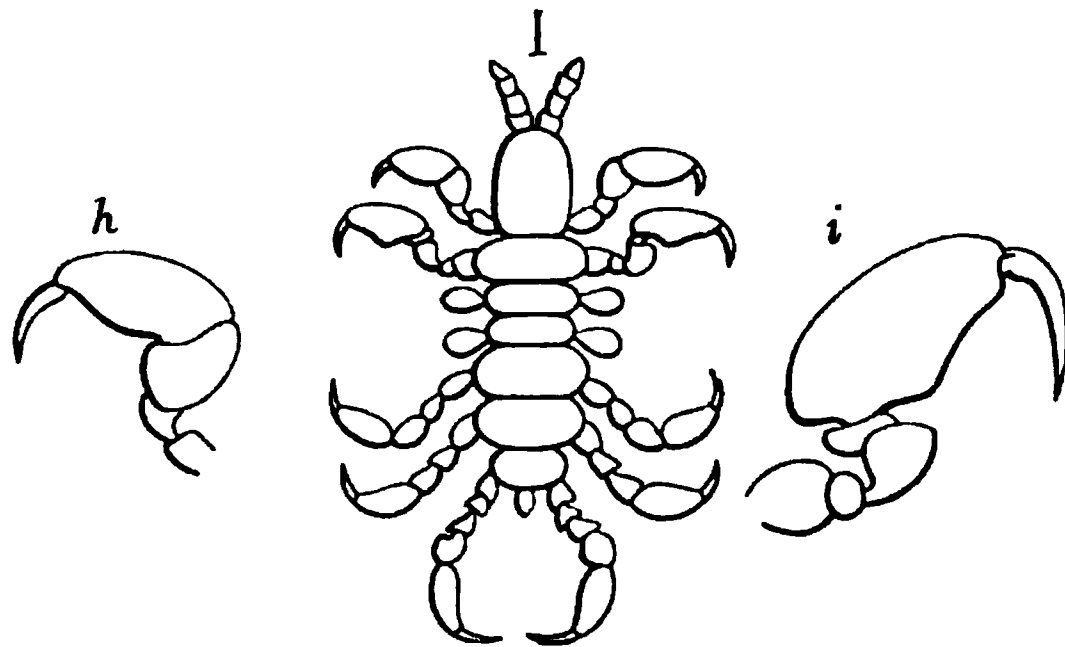
fourth segments furnished with large foliaceous plates, forming an incubatory sac.

We have no precise details of the locality and notice of capture of this species beyond the general statement of its being found on the whale in the British seas. British specimens exist, however, in the British Museum, as well as in the Hopeian, Stephensian and Westwoodian collections, now in the Oxford Museum, &c.

On some of the females which we have examined, we have found the young fixed firmly to different parts of the body, about one-twelfth of an inch long, distinguished from their parents by the proportionally larger size of the head (with which the following segment is confluent), the shorter antennæ, and especially by the size of the first pairs of legs, which are equal to the following, all being small, and much less strongly dilated than in the adult state, and also by the small rudimental size of the branchiæ.

M. Roussel de Vauzeme informs us that the species of *Cyamus* to which he gives the name of *C. erraticus*, and which we have regarded as the true Linnean *C. ceti*, differs considerably in its habits from the other species of the genus which he had observed. The former species attaches itself at the base of the tubercles of the different parts of the head, fixed upon the smooth skin in the intervals between them, and but rarely mingling with *Cyamus ovalis*. They, however, wander about over different parts of the body, or hide themselves in the folds of the eyebrows, the commissure of the lips, navel, genital and anal parts. They also especially attach themselves to wounded parts of the body, and on one occasion M. Roussel found a whale injured by the swordfish, the suppurating wound of which had attracted a vast number of individuals of this species. The structure of the

body and limbs of this species, indeed, are eminently fitted for its wandering mode of life; its more slender body, with longer hooks to the claw-legs, enabling it to withstand the shock of the waves on the naked parts of the body of the whale, whereas the structure of the legs of *C. gracilis* compel it to a sedentary mode of life.



CYAMUS CETI, YOUNG.

AMPHIPODA.
ABERRANTIA.

CYAMIDÆ.

♀

♂

CYAMUS OVALIS.

Specific character. Body depressed, elliptic-ovate, with the segments not gaping apart at the sides. Third and fourth segments of body, with two pairs of branchiæ on each side, of unequal length; those of the third segment having at the base only a short slender appendage, those of the fourth segment having two appendages of unequal size at the base. Head of the second pair of legs with two obtuse teeth.

Length about half an inch.

Cyamus ovalis. ROUSSEL DE VAUZERME. Ann. Sci. Nat. 2nd ser. vol. i. p. 259, pl. 8, fig. 1-21. MILNE EDWARDS, Hist. N. Crust. iii. p. 113. Ann. Sci. Nat. 2nd ser. iii. pl. 14, fig. 13, 14. Règne An. ed. Crochard Crust. pl. 63, fig. 3. GUÉMIN, Icon. R. An. Crust. pl. xxviii. fig. 4. WHITE, Pop. Hist. Brit. Crust. p. 219. Cat. Brit. Crust., p. 62. GOSSEN, Marine Zool. i. p. 81. SPENCE BATE, Cat. Amph. Brit. Mus. p. 367, pl. lviii. fig. 3. Ann. Nat. Hist. (Feb. 1857), 2nd ser. xix. p. 152.

THIS species is indicated as British by Mr. Adam White in his "Catalogue of the British Crustacea," but we have seen no specimen which we are able to identify with M. Roussel de Vauzeme's figures, which we have consequently been under the necessity of copying in the accompanying woodcut.* This species is at once distinguished from *C. ceti* by its elliptic-ovate form, by the

* The figure on the right hand represents the male, seen on its ventral surface, whilst the left-hand figure represents the under surface of the body of the female, showing the incubatory pouch.

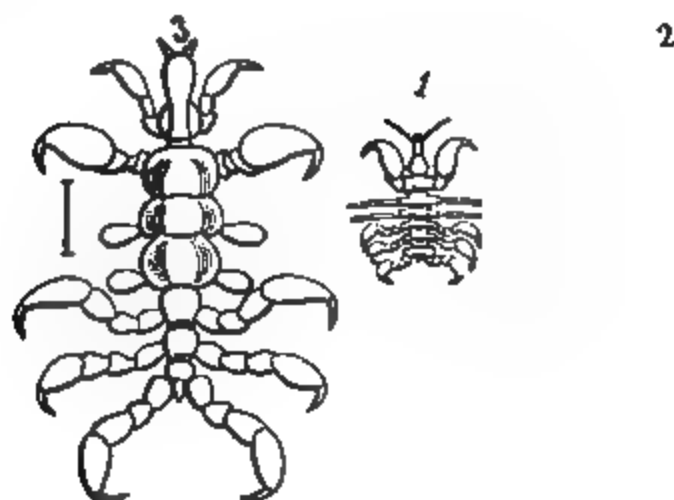
segments being not wide apart at the lateral margins, and by the possession of *two* slender filiform branchiæ attached to each side of the third and fourth segments of the body. The species represented by Mr. Spence Bate (Plate 58, fig. 3) is from the Cape of Good Hope, and possesses a very strong tooth near the extremity of the fourth joint of the second pair of legs. We presume, notwithstanding its locality, that it is identical with M. Roussel de Vauzeme's species. The branchial appendages of the males are longer than those of the females. In the species before us the anterior pair are furnished at the base with a single pointed appendage, whilst the posterior pair have this appendage doubled, its branches being rather unequal in size; these appendages exist in the female in the modified form of large flattened plates, or valves, extending beneath the middle of the body. These plates are concave, pedunculated, fringed at the edges, and formed of a double transparent membrane: thus constituting a sac without an external orifice. These plates, lying upon each other, serve as a pouch, within which the eggs are deposited, and the young hatched. Some uncertainty has been entertained as to the real nature of the branchial appendages, which have been regarded as simple stems, false legs, pseudo-branchiæ, vesicles without determinate use, and organs of respiration; but the direct observation of M. Roussel on the living animals has demonstrated that they are branchial canals in communication with the dorsal vessel, and of a membranous texture, whilst the appendages at their bases in the male are differently organized, being crustaceous, and unfitted for organs of respiration; and the plates of the ovigerous pouch in the female are also destitute of branchial canals, and consequently unable to perform the functions of gills.

According, also, to M. Roussel de Vauzeme, *Cyamus ovalis*, as well as *C. gracilis*, are only found upon the tubercles of the chin, lips, and upper jaw of the whale, and especially upon the larger tubercle of the head, which the whale-fishers call the crown, near the blow-holes, and the horny excrescences with which it is surrounded. Sometimes, indeed, *C. ovalis* is found in such vast numbers in this last situation, that at a considerable distance the patch of white colour, produced by their presence, may be observed when the whale comes to the surface to breathe. In this situation the individuals of *C. ovalis* arrange themselves with considerable regularity, by which they are distinguished from *C. gracilis*, which are scattered about more irregularly.

The young of *C. ovalis*, as figured by M. Guérin Mèneville, in the "Iconographie du Règne Animal," is more regularly elongate-ovate than the young of *C. ceti*, as figured above by ourselves, with the legs almost cylindrical, the fourth joint but moderately dilated; indeed, according to M. Milne Edwards (Ann. Sci. Nat. vol. iii. p. 329), "Les jeunes *Cyamus* ont une forme svelte et élancée," all the segments being perfectly alike, resembling portions of a cylinder with the legs "grêles, cylindriques, et parfaitement extensibles;" and with the branchial vesicles not more developed than in *Proto*, *Caprella*, &c.

AMPHIPODA.
ABERRANTIA.

CYAMIDÆ.



CYAMUS GRACILIS.

Specific character. Body small, oblong; segments of the body emarginate at their lateral margins. Third and fourth segments of the body with a pedunculated branchia on each side, each furnished at its base with two very short appendages. Second pair of hands with the palm slightly concave.

Length $\frac{1}{4}$ inch.

Cyamus gracilis. ROUSSEL DE VAUZEME, Ann. Sci. Nat. 2nd ser. vol. i. p. 243, pl. 8, fig. 24, 25. MILNE EDWARDS, Hist. N. Crust. iii. p. 113. SPENCE BATE, Cat. Amph. Brit. Mus. p. 366, pl. lviii. fig. 1. GOSSE, Mar. Zool. i. p. 131. WHITE, Pop. Hist. Brit. Crust. p. 219.

Our figures of this species represent, firstly (the central figure), the animal as drawn of the natural size by M. Roussel de Vauzeme; secondly (the right-hand figure), a copy of Mr. Spence Bate's figure (Pl. 58, fig. 1), drawn from individuals in the Paris Museum, found at the Cape of Good Hope, and also taken during the voyage of the *Chevrotte*, but without any indication of locality; and thirdly (the left hand-figure), an animal in the British Museum, to which the same name has been applied, and which is stated by Mr. Adam White to inhabit the British seas; it is evidently an individual in an immature state, having minute antennæ, and the

first pair of legs of moderately large size, although smaller than the following limbs. The species, according to M. Roussel de Vauzeme, has the body small and oblong, with a single branchia attached to each side of the third and fourth segments, each branchia having two very short appendages at its base, and the second pair of legs have the large penultimate joint with a slight concave impression on their under surface. We regret that our ignorance of the precise locality of the supposed British specimen above mentioned, and its immature condition, as well as the very concise notice of this species by M. Roussel himself, prevent us from giving a satisfactory account of it. The only notice of its habits, as distinct from those of *C. ovalis*, has been already detailed by us in our account of the last-named species.

AMPHIPODA.
ABERRANTIA.

CYAMIDÆ.

CYAMUS THOMPSONI.

Specific character. Head triangular; antennæ very short; two middle segments of body narrower than the preceding and following. First and second pairs of legs equal in size, and not larger than the posterior pairs. Third and fourth segments with a single very short oval branchia on each side.

Length about one-sixth of an inch.

- Cyamus Thompsoni.* GOSSE, Mar. Zool. i. p. 181. Ann. Nat. Hist. xvi. p. 30, pl. iii. fig. 11 (1855). WHITE, Pop. Hist. Crust. p. 219, fig. 225.
- Cyamus Thomsoni.* SPENCE BATE, Cat. Amph. Brit. Mus. p. 368, pl. lviii. fig. 5. Ann. Nat. 2nd ser. xx. p. 525 (Jan. 1858).
- Cyamus Delphinii.* GÜNTHER MÈNEVILLE, Iconogr. R. An. Crust. texte p. 25, pl. xxviii. fig. 5 (adult state ?)
- Cyamus gracilis.* SPENCE BATE, Ann. Nat. Hist. 2nd ser. xix. p. 152 (Feb. 1857).

THE animal which forms the type of Mr. Gosse's species is fortunately preserved in the British Museum collection, and has served us for the accompanying figure. It is evidently in an immature state, as shown by the small size of the antennæ, the uniform size of the legs, and the rudimental condition of the branchiæ; the legs, however, are considerably stronger than in the young

of *C. ceti*, which we have represented in our figures in page 90; and in all, the penultimate joint is large and angulated in the middle of its lower edge.

The specimen was obtained by Mr. William Thompson, of Weymouth, attached to an individual of *Hyperoodon bidens* captured in Portland Roads in 1854. This is the species referred to by Mr. Spence Bate in the "Annals of Natural History," for February, 1857, 2nd Series, under the name "*C. — ? C. gracilis*. Gosse," as stated by Mr. Bate himself in the same work, 2nd Series, vol. xx. p. 525, where it is referred to *C. Thomsoni* [*Thompsoni*]. Gosse, "Ann. Nat. Hist.," vol. xviii. [xvi.] 1855.

In our introductory observations on the genus, we have seen that M. Roussel de Vauzeme had not observed any species of this genus on any of the dolphins; but the capture of this specimen by Mr. Gosse disproves such a statement, whilst M. Guérin Mèneville, in his "Iconographie du Règne Animal,"* has described and figured a species under the name of *C. delphinii*, taken upon the generative organs of the dolphin on the coast of the Antilles. It is of an oval-elongated form, with the segments of the body touching each other at the sides except the terminal ones, which are a little gaping. The great joint of the second legs bears a strong tooth on its under edge, the branchial filaments (one on each side of the third and fourth segments) are very short, and much shorter than the legs. The basal articulations of the hind legs are strongly dentated and various in form. Mr. Spence Bate (Cat. Amph. p. 366) considers this species to be only a variety of *C. gracilis*. It has, however, to be determined whether the animal is uniform in its residence on the dolphin, or only exceptional, as

* Crust. texte, p. 25.

appears probable from the absence of specimens; if the former be the case we should not hesitate to regard it as a distinct species, of which the precise characters have to be detailed. How far, also, it is identical with Mr. Gosse's animal must be left for future determination, when the immature states of *C. delphinii* shall have been ascertained.



CYAMUS DELPHINII, G. M., MALE AND FEMALE.

Order—ISOPODA.

THIS order of Crustacea was first defined by Latreille, and was named Isopoda, in contradistinction to the Amphipoda, from the Greek words ἴσος, equal, and πόδες, feet, in allusion to the general conformity in size and function of the seven pairs of legs, the two anterior pairs of which, as in the Amphipods, are the homologues of the two outer pairs of foot-jaws of the Decapod Crustaceans. If we were to adopt the ideas of some writers, that large size constituted the especial character of a typical group, we should be compelled to regard the last-named animals as the types of the class Crustacea, and should be, consequently, obliged to consider the Isopods as further removed from the type than the Amphipods, in consequence of the former being destitute of branchial appendages, in the shape of vesicles, affixed to the base of the legs (a character which constitutes a marked distinction between the two orders which form the subjects of this work), and by the possession of which the Amphipoda are more nearly approximated to the Decapoda. If, on the other hand, the type of the articulated class of animals is to be sought for in such members as present a more regularly articulated body, each articulation being furnished with a pair of equal-sized articulated limbs, we must consider the animals of the present order as more typical of the Crustacean class than the Amphipoda. In immediate connection with the character derived from the want of branchial appendages attached to the base

of the legs, is that presented by the structure of the appendages of the tail, which in the Isopods support organs of respiration, varying considerably in their formation in the different groups, instead of serving, as in the Amphipods, for purposes chiefly of locomotion.

Another character which was employed by Latreille to distinguish the majority of these animals from the Amphipoda, namely, the want of an articulated appendage to the hard horny mandibles, is by no means a constant one, since although the Idoteidæ, Oniscidæ, and Anceidæ are destitute of such an appendage, it occurs in the Asellita, Sphæromidæ, and Cymotheidæ (of which last we possess no hitherto recorded representative in these islands).

With the Amphipoda the Isopoda are closely connected through the aberrant families of each order.

In the genus *Cyamus* the lowest form of Amphipod with which we are at present acquainted, the Isopodal appearance is very considerable ; so great indeed that at one time the genus was grouped with this order ; and, in fact, it can only be separated from it by virtue of the branchial organs that are attached to the body ; and even these are reduced to two pairs only. In *Cyamus* also (as in the *Caprellæ*), the head is confluent with the first segment of the body, and the tail is reduced to a rudimentary condition.

If we turn to the genus *Tanais*, among the aberrant Isopods, we have an animal that is capable of being separated from the Amphipoda only by virtue of its caudal appendages. The head in this genus is confluent with the first segment of the body ; and a pair of branchial vesicles (organs especially characteristic of the true Amphipoda) are attached to the third pair of pereopoda (or fifth pair of feet), and the natatory or tail-feet, instead of being simple branchial plates, are foliaceous appen-

dages that are evidently powerful for swimming purposes. They are biramous, and consist, as in Amphipoda, of three pairs; moreover, the form of the body and the large size and cheliferous condition of the first, or (as in Apseudes) of the first and second pairs of legs (gnathopoda), remind us of the Amphipodous rather than of the Isopodous type.

By Linnæus the animals of this order were arranged almost entirely under the single genus *Oniscus*, and from their flattened oval form they bear a certain general resemblance to the Brachyurous Decapods, especially to such anomalous genera as *Remipes* and *Hippa*; whilst the Amphipods, from their compressed or cylindrical form, may be considered more especially as the representatives of the Macrourous division. This system of analogy is also supported by the movements of the animals in these several groups, the Brachyura and Isopoda being pre-eminently crawlers; whilst the Macroura and Amphipoda are powerful swimmers, both of the last-named sets of animals using the tail as the principal organ of progression. The body of the Isopods is depressed, generally broad, and of an oval form; in some few cases it is narrow (as in the *Apseudes*, *Arcturus*, and *Anthura*); in others, *Sphæromidæ* and *Armadillidæ*, it is constructed so as to be capable of being rolled up into a ball, and in a few it is unsymmetrical, as in the females of certain *Bopyridæ*. The texture of the outer integument is of a firmer consistence than in the Amphipoda; although in some of the parasitic species it is soft and almost fleshy. The head, except in some of the aberrant families, is distinct from the body, as are the several segments from each other. In the *Anceidæ*, which possess only five pairs of legs adapted for walking, the three posterior segments of the body of the female are more or

less soldered together. There is considerable difference in the number of segments composing the tail (pleon), the terminal piece of which is often of large size; and there is also considerable diversity in the structure and functions of the appendages of the tail segments (pleon), which never form multiarticulated appendages, as we have seen to be the case with the pleopoda, or tail-feet of the Amphipoda.

Except in the aberrant families, the head is generally small, and is never confluent with the following segment. The eyes are fixed at the sides of the upper surface. These organs vary considerably in size in the different groups, occupying nearly the whole upper surface of the head in the Rocinela, and being almost obsolete in some species in which the tegument of the head, over the place of these organs, appears smooth and transparent, whilst in other cases the very distinct and large size of the hexagonal lenses is very marked.

The antennae occupy the anterior part of the head, and consist of two pairs, generally small, or of but moderate length; sometimes, indeed, the upper pair are rudimentary, as in many of the Oniscidae. They generally consist of three large basal joints and a multiarticulate terminal slender filament; sometimes, however, the latter part is very much reduced in the number of its articulations, which are enlarged, so as to appear as though regularly continuous with the basal joints. The first pair of antennae, except in the aberrant genus Apseudes, is never furnished with a secondary appendage at the base of the fourth joint, which is so constantly the case in the Amphipoda (being either large or rudimentary in the larva or adult stages, so that it may possibly be a universal feature of that order).

The parts of the mouth are generally strongly deve-

loped, with the mandibles large and horny, the animals being especially scavengers in their habits. The upper lip is large and transverse, or somewhat triangular in form; the mandibles are generally subtriangular in form, with a large prominent terminal dentated piece, below which, in some groups, is a small secondary movable denticulated appendage; many of the species have this organ furnished with a three-jointed* palpiform appendage, or rather (if we adopt the theory of these mouth-organs being only modified limbs) the basal horny part of the mandibles is composed of two or three joints soldered together, whilst the terminal joints are reproduced in the shape of a palpus, which is, however, obsolete in certain groups.† The mandibles are succeeded by two pairs of maxillæ, which are generally of a delicate texture, the anterior pair composed of two terminal subcylindrical curved lobes, with strong spines at the tips, whilst the posterior pair consist of three delicate membranous plates affixed to a basal stem. There is, however, considerable difference in the structure of these organs in the different groups. The pair of foot-jaws closing the mouth beneath is generally of large size, the basal portion often defended at each side by a large triangular plate, whilst the terminal joints form a large and broad palpus, shutting over the sides of the mouth, which is, moreover, provided in its inner portion with a bilobed lower lip of considerable size.

The segments of the body, seven in number, are gene-

* Savigny (Egypte Crust., Pl. 12, fig. 14) represents the mandibular appendage of *Sphæroma* as four-jointed, having mistaken a twist in the second joint for an articulation.

† The structure of the mandibles in *Maia Squinado*, and *Nebalia*, for example, affords strong presumption of the correctness of this view of the subject, the basal portion, although exarticulate, showing the three divisions of which it is composed thoroughly soldered together.

rally nearly equal in size,* movable, and with the posterior lateral angles generally extending backwards over the base of the legs. The large dorsal arc of each segment is accompanied at each side with a small but distinct plate (epimeron of M. Milne Edwards), on the underside of which the corresponding leg is affixed. These scale-like pieces, which are the first joints of the legs, are often soldered to the dorsal arc, their limits being indicated by impressed lines; but in other cases, as in *Rocinela*, *Æga*, &c., they are very distinct, forming acute lateral points to the segments. The legs are, for the most part, of small size, and more or less uniform in shape: they are (generally) affixed to the lateral margins of the underside of the body, the basal joint being long and lying flat on the breast, its extremity being brought into contact with the extremity of the basal joint of the opposite leg, whilst the second and following joints of the leg are affixed at an angle and directed outwards. This arrangement of the limbs is especially marked in the anterior pairs, which thus put on the appearance of outer mouth-organs. The legs generally terminate in hook-shaped fingers, which, especially in the parasitical species, are of considerable size and power. In the arrangement of these limbs there may, however, notwithstanding their general conformity, be observed somewhat of the division into series which we have alluded to in our introduction to the Amphipoda (vol. i. p. 7). Thus in *Arcturus* the first pair, the second, third and fourth pairs, and the three posterior pairs, constitute distinct series both in structure and function, whilst in *Serolis* and *Apseudes* the first pair is as greatly

* In *Tanais*, which in some respects might almost be regarded as the link between the Isopoda and the Squillidæ, the first segment of the body is of large size, and is confluent with the head.

developed as the corresponding pair of legs of *Squilla*, which bears a large pair of sabre-like claws; indeed, this arrangement of the limbs in *Arcturus* very satisfactorily settles the question of the homologues of the limbs of *Squilla*, which has been the subject of some discussion. In the true Isopoda, however, the three anterior pairs of legs are directed forwards, and the four posterior pairs backwards, thus differing from the Amphipoda.

In the female Isopoda the legs are provided at the base with a series of large membranous plates, arranged so as to lie in a horizontal position, overlapping one another, and together forming a pereionic pouch within which the eggs are lodged during incubation, and the young are retained for some time after they are hatched. The respiratory apparatus of these animals being different from that of the Amphipoda, the vesicular appendages, which exist at the base of the legs of the latter, serving as branchiæ (vol. i. fig. * 1'''), are not found in the Isopods,* their duty as organs of breathing being transferred to, and performed by, the organs attached to the pleopoda (tail-legs), modified in various ways. The tail (pleon) is always short, but well developed; the six joints of which it is composed are often more or less fused together; thus, whilst in the Ligiidæ the six segments are all distinct, in the Asellidæ they are almost reduced to one very large terminal plate. The five anterior pairs of appendages attached to the underside of these tail segments are employed as respiratory organs, and consist of a peduncle, bearing at its extremity two large oval, movable, folia-

* Except, as before remarked in the genus *Tanais*, and also in the genus *Ione*, which Latreille was thence induced to place in the order Amphipoda, but which Prof. Milne Edwards considered to belong to the Isopoda, allied to the Cymothoidæ (*Règne An.*, Ed. Crochard, Crust., pl. 59, fig. 1). It appears to us to be most nearly allied to the Bopyridæ, especially to the recently established genera *Athelgue* and *Prosthete*.

ceous plates, membranous in their texture, and arranged so that one lies upon and protects the other, the inner of which is generally more delicate than the outer one, and the two penultimate (*s.-t.*) are generally furnished with true branchiæ attached to the posterior surface of the inner plate. The arrangement of these organs in the Anceidæ is very remarkable, the two pairs of plates attached to each of the five basal segments being small and free, as in *Squilla*, the tail, also, being terminated by a five-plated apparatus. This peculiarity in the branchial organs formed the subject of a communication made by Professor Westwood to the British Association, in the year 1832 (p. 593).

In the female of the remarkable genus *Ione* each of the five basal segments of the tail is furnished with a pair of long branching very slender filaments, somewhat resembling a piece of coral in miniature; whether these be employed as respiratory organs has not been observed, the long filiform appendages attached to the three anterior pairs of legs having been regarded as employed in breathing. The posterior pair of pleopoda always, however, differ from the preceding pairs, and either form a pair of strong valves, shutting together in a straight line so as to cover and protect the other respiratory plates, as in *Idotea*, or are transformed into a pair of double or single branched crustaceous plates (*Sphæroma*, &c., *Oniscus*, &c.), forming, with the central apical plate of the tail, a fan-like appendage of three or five pieces, similar to that which terminates the body of the macrourous decapoda, or these lateral appendages are elongated into long terminal filaments which sometimes, as in *Ligia italica* and *Apseudes talpa*, equal the entire body in length.

The majority of the Isopoda being aquatic, respiration takes place by means of the pleopoda transformed

into branchiæ variously arranged, as above described; but in the terrestrial species of the Oniscidæ a remarkable modification exists in the structure of these same appendages, to fit them for performing the office of respiration to animals which would be destroyed if immersed in the fluid from which the aquatic species are enabled to obtain their necessary supplies of oxygen. Instead, therefore, of acting as gills, the two or four anterior pairs of these organs are transformed into lungs, their interior being furnished with canals into which the atmospheric air penetrates by means of orifices answering to the spiracles of insects, and which, although generally very minute and numerous, are of large size and very distinct in the genus *Tylos*, Latr., inhabiting the shores of the Mediterranean, for the details of which we are indebted to Savigny's beautiful figures in the great work on Egypt. It is, moreover, worthy of notice, with reference to the correlation of organs, that in these terrestrial species the internal pair of antennæ are so extremely minute as to be scarcely visible, consisting of a small three-jointed style, whilst the exterior pair are of large size.

The nervous system of these animals approaches nearly to that of the true insects, consisting of a double thread united together at intervals by ganglions, the second and six following of which send off nerves to the seven pairs of legs; thus showing that the two anterior pairs, although homologous with the two outer pairs of mouth-organs of the Decapods, are really legs in the true sense of the word. The segments composing the tail receive the whole of their nerves from the terminal ganglion; a fact of much significance with reference to the real homologues of the segmental development of these Crustaceans. This description is founded on the observations of M. Cuvier and our own dissections of *Ligia*; but

Mr. Dana insists that the Isopods have but a single cord between the ganglia, whilst it is doubled in the Amphipods, founding thereon an argument of inferiority in the double-corded Amphipods, the single cord only appearing in the higher Crustacea, whilst its existence in a double state indicates a diminution in the nervous influence of the creatures. He has omitted to state upon what species he has founded his observations; but Brandt (Med. Zool., vol. ii. p. 76, Pl. XV., fig. 28) decidedly figures the nervous system of the Oniscidæ as consisting of a double cord; and the same fact has also still more recently been clearly demonstrated by Franz Leydig in his excellent "Tafeln z. Vergl. Anat.," 1864, Pl. VI., f. 7, representing the nervous system of *Porcellio scaber*.

According to Edwards and Audouin, there is a ganglion to each segment of the pleon.

The male external organs of generation consist of a pair of linear or filiform appendages or hooks near the base of the hind legs, or between the base of the anterior pair of appendages of the pleon, except in *Anceus*, which Mr. Hesse has recently demonstrated to be the male of *Praniza*, in which the organ is a single median intromittant process.

The young when hatched differ from the perfect animals in possessing a narrower form, and with the limbs not fully developed, and in some genera with fewer segments to the pereion at the period that the larva quits the egg. During the period of embryonic existence, according to the observation of Dr. Fritz Müller, the animal within the ovum is rolled outwards except in the aberrant Isopoda, which in this resemble the Amphipoda by being rolled inwards.

The classification of the ISOPODA, with reference to the affinities of the different animals amongst themselves and

their relations to the other Edriophthalma, is by no means satisfactory. If the organs of locomotion and those of manducation and respiration, together with the relative position of the latter, are regarded as affording the primary distinctions between the Amphipoda and Isopoda, we must regard those Isopods as pre-eminently typical of the order which possess the greatest uniformity in the structure of the legs, and which have the breathing apparatus affixed to the underside of the tail instead of the body, and which are destitute of a palpiform appendage to their mandibles. The Idoteidæ and Oniscidæ fulfil these conditions most completely, the former agreeing with the great majority of the order in having a branchial apparatus fitted for the use of aquatic existence, whilst the Oniscidæ differ from all the rest in having the branchiæ transformed into lungs. The Oniscidæ, moreover, are terrestrial, or, at least, found in damp situations, where they breathe the free air, and these can scarcely, therefore, be regarded as pre-eminently typical of an extensive series of groups, all the rest of which are aquatic. The great family of Sphæromidæ fulfil the greater portion of the conditions of a typical group set down above, but they have a palpiform appendage to the mandibles; on the whole, however, they appear to constitute a well-marked ovate or globose type of the order, whilst the Idoteidæ have a more elongated general form. We therefore accept *Ligia*, holding, as it does, an intermediate position between the aquatic and air-breathing Isopoda, as the most typical genus of this order. All the remaining tribes are more or less differentiated.

As the British species of Isopoda contain representatives of nearly all the known groups into which the order has been subdivided, it will be necessary to notice the

chief modes of distribution of the groups hitherto proposed.

Latreille, having separated the anomalous genera *Ione*, *Apseudes*, *Anceus*, and *Praniza* (which he placed among the Amphipoda), divided the remainder of the order into six sections :—

1. EPICARIDES (Genus, *Bopyrus*);
2. CYMOTHODA (*Serolis*, *Cymothoa*, &c.);
3. SPHÆROMIDES (*Sphæroma*, &c., *Anthura*);
4. IDOTEIDES (*Idotea*, *Arcturus*);
5. ASELLOTA (*Asellus*, &c.);
6. ONISCIDES (*Ligia*, *Oniscus*, &c.);

thus commencing with the abnormal parasitic species, and terminating with the terrestrial ones.

Professor Milne Edwards adopted a different principle of classification, dividing the order into three sections :—

1. ISOPODES MARCHEURS, in which the terminal appendages of the tail are styliform or opercular, and never formed into swimming appendages, consisting of three families—Idoteides (Genera, *Arcturus*, *Idotea*, and *Anthura*). 2. Asellotes (Genera, *Apseudes*, *Tanais*, *Limnoria*, *Asellus*, &c.). 3. Cloportes (Genera, *Ligia*, *Oniscus*, &c.).

2. ISOPODES NAGEURS, in which the terminal appendages of the tail form a swimming apparatus, consisting of three families :—1. Praniziens (Genera, *Praniza* and *Anceus*). 2. Sphæromiens (Genera, *Sphæroma* and *Ancinus* (allied to *Serolis* ?). 3. Cymothoadiens (Genera, *Serolis*, *Æga*, *Cirolana*, and *Cymothoa*, &c.).

3. ISOPODES SEDENTAIRES, with the mouth more or less rudimentary (Genera, *Bopyrus* and *Ione*).

Here we find the four anomalous genera placed by Latreille among the Amphipoda referred to the present order, and Latreille's general arrangement nearly re-

versed. In other respects the groups proposed by M. Edwards are natural ones, except the Asellotes, which appear to us unnaturally increased by the introduction of the genera *Apseudes* and *Tanais*.

The classification of these animals by Mr. Dana, who has bestowed an unusual amount of attention upon the class Crustacea, demands a more extended notice.

Rejecting the division of the Crustacea into, 1, those with proper jaws; 2, suctorial species; and 3, those with the basal joints of the feet acting as jaws,* as proposed by Milne Edwards, on the consideration that too great a stress has been laid upon the organs of manducation, Mr. Dana proposes to adopt three primary divisions: 1, Podophthalmia; 2, Edriophthalmia, comprising the whole of the remainder of the Crustacea proper; and 3, the Cirripedia: dividing the Edriophthalmia into, 1, Choristopoda (or Tetradecapoda); 2, Trilobita; 3, Entomostraca; and 4, Rotifera.

In the revision of the classification of the Crustacea given in the latter portion of his great work (founded upon subsequently-acquired views of Cephalization and consequent concentration or dispersion of forces), Mr. Dana modified this arrangement of his primary groups, giving five subclasses, namely—I. Podophthalmia (or Decapoda, including *Mysis* and *Squilla*); II. Tetradecapoda—Order 1, Choristopoda; Tribe 1, Isopoda; Tribe 2, Anisopoda; Tribe 3, Amphipoda: Order 2, Trilobita, of doubtful situation; III. Entomostraca; IV. Cirripedia; V. Rotatoria.

Thus his Choristopoda are equivalent to Leach's Edriophthalma. Here also, rejecting Latreille's order Læmopoda, Mr. Dana admits two prominent groups; the

* Mr. Dana (Crustacea, p. 9), by a strange mistake, speaks of the basal joints of the feet acting as legs instead of jaws.

Amphipoda, which form the subject of our former volume, and the Isopoda, in which the tail is short, with the articulations admitting of little flexion, and with four or five pairs of abdominal appendages, which are lamellar and branchial, and only the posterior styliiform. The Isopoda, moreover, are further distinguished by having only the three anterior pairs of thoracic feet directed forwards (instead of four, as in the Amphipoda), and four pairs directed backwards.

These two primary groups he, moreover, considers to be united together by such genera as *Tanais*, *Arcturus*, &c., which he affirms agree with the Amphipoda, in having the four anterior pairs of legs directed forwards, and the three posterior pairs backwards; but, like the Isopods, they have the pleon very short, with only the last pair of members styliiform, the others being lamellar and branchial, as in the Isopods. These, therefore, he proposes to form into a third tribe, to be called *Anisopoda*.

As the most recent revision of the animals comprised in the present volume, it will be useful to give the following condensed sketch of his arrangement of the two tribes, *Isopoda* and *Anisopoda*.

Tribe 1, *Isopoda*.

Subtribe 1, *Idotæidea*.

Fam. 1, *Idotæidæ*.

Fam. 2, *Chaetilidæ*.

Subtribe 2, *Oniscoidea*.

Fam. 1, *Armadillidæ*.—Subfam. 1, *Tylinæ*; subfam. 2, *Armadillinæ*.

Fam. 2, *Oniscidæ*.—Subfam. 1, *Oniscinæ*; subfam. 2, *Scyphacinæ*; subfam. 3, *Lyginæ*.

Fam. 3, *Asellidæ*.—Subfam. 1, *Limnorinæ*; subfam. 2, *Asellinæ*.

Subtribe 2, Arcturidea (*Anisopoda Idotæica*).

Fam. 1, Arcturidæ.—Subfam. 1, Arcturinæ; subfam. 2, Anthurinæ.

Subtribe 3, Tanaidea (*Anisopoda Oniscica*).

Fam. 1, Tanaidæ.—Subfam. 1, Tanainæ; subfam. 2, Liriopinæ; subfam. 3, Crossurinæ.

Fam. 2, Bopyridæ.—Subfam. 1, Bopyrinæ; subfam. 2, Ioninæ.

Of the few divisions, the names of which are printed in italics, no representatives have hitherto been detected in the British Seas. This is the more remarkable as regards the entire parasitic family, CYMOTHOIDÆ, composed as it is of three subfamilies. Of the remaining extra British groups, the CHÆTILIDÆ is composed of the single genus *Chaetilia*, Dana, with the sixth pair of legs exceedingly long and multiarticulate, founded on a Patagonia species; the TYLINÆ is composed of the spiracled-branchial *Tylos*, Latreille, from the shores of the Mediterranean. The SCYPHACINÆ, consists of the genera *Scyphax*, with one species from New Zealand, and *Styloniscus*, with two species from Terra del Fuego and the Friendly Islands; the ANCININÆ, of doubtful location, is composed of the genus *Ancinus*, Edwards; and the SEROLIDÆ, composed of the flattened genus *Serolis*, from the Southern Seas, with strong claws to the fore legs.

Of the subdivisions composing the three subtribes of Isopoda proper we can speak with satisfaction; but the whole arrangement of the Anisopoda seems to us unnatural: thus, referring only to the British groups, we consider, 1st, that an arrangement which can group together the female of *Anceus* (Praniza) and *Serolis* must be founded upon entirely false principles. 2ndly, that *Arcturus*, although exhibiting a remarkable modification in its legs and basal segments of its tail, possesses

so strong a relationship to *Idotea*, through its opercular breathing apparatus, that it ought not to be far removed from it. So, also, *Anthura*, although the structure of the breathing apparatus of the tail appendages is very peculiar, possesses in its elongated form and nearly uniform feet only a relation of analogy with *Arcturus*, its relation with *Tanais* having been hitherto mistaken. 3rdly, the *Liriopinæ* are more properly referable to the *Bopyridæ*. 4thly, the *Crossurinæ* are synonymous with *Tanais*, the genus *Crossurus* (Rathke), on which Dana has founded the subfamily, being a true *Tanais*. And 5thly, the *Bopyrinæ* are strictly Isopods so far as the legs are concerned; the structure of the mouth, parasitic habits, and remarkably degraded condition of the female sex, constituting them into a solitary group far removed from the other Isopods, and analogous to the *Hyperiidæ* among the Amphipoda. With these prefatory remarks we beg to propose the following tabular arrangement of the Order, in which we have availed ourselves of the most important peculiarities of each mode of classification alluded to above. We consider, on the one hand, that *Tanais*, by the presence of branchial vesicles attached to the body, approaches nearest to the Amphipoda, and, on the other hand, that *Oniscus*, from the presence of internal spiracles, as has been recently shown by Wagner,* comes nearest to the *Insecta*, and, consequently, these two genera form the extreme limits of the order.

* Ann. Sci. Nat. tom. iv. p. 323, 1865.

TABULAR ARRANGEMENT OF THE BRITISH ISOPODA.

| Order. | Group. | Division. | Tribes. | Sub-tribe. | Family. | Sub-family. | Genera. |
|----------|-------------|--|----------------|------------|----------|-------------|---|
| ISOPODA. | Aberrantia. | | Vagantia. | { | { | { | Tanais, Leptochelia, Paratanaia, Ap- [scudae] Anthura, Paranthura. |
| | | | | | | | |
| | | | Sub-parasitica | { | Acocidae | | Anceus (id. ♀ = Pranias). |
| | Normalia. | | Parasitica | { | { | { | Ione, Bopyrus, Liriope, &c. No representative.) Ega, Burydice, Cirolana, Conilera, Rocinela, &c. |
| | | | | | | | |
| | | | Liberatica | { | { | { | Asellus, Limnoria, Munna. Cy. represented. |
| | | | | | | | |
| | | Aero- spirantia, or Air breathers | | { | { | { | Sphaeroma, Neera, Campecopes, &c. |
| | | | | | | | |
| | | | | | | | |

* * The Table given above has been drawn up by Mr. Spence Bate, and substituted for one proposed by myself, in which Arcturus, as the connecting link between the Idoteidae and the Canrellae, was placed at the head of the order, and the Bopyridae, from their very degraded (so to speak) condition, were removed to the end, the views of Dana, with Anthura in ment so as to give due weight to a ex- portant physiological conditions, and
 essor Milne Edwards; the other families being distributed more in accordance with
 I Idotea and Asellus with Lygia. The impossibility of applying a linear arrange-
 induces me to adopt the classification of my colleague, founded, as it is, upon im-
 isopoda with that of Latreille. J. O. W.

Group—ABERRANTIA.

THIS group is formed of those crustacea which, although belonging in certain important conditions to the order Isopoda, offer peculiar aberrant characters.

In the Amphipoda the branchial organs are (as in the Podophthalmic orders) attached to the appendages of the body. In the aquatic Isopoda they are attached to the fourth and fifth pairs of the appendages of the tail. But in the several genera which we link together to form this group, the branchial organs have not been made out; indeed, both Dr. Fritz Müller and Prof. Lilljeborg assert that no such organs exist.

In one genus alone (and possibly only in certain individuals of that genus) we have detected a saccular appendage attached to the coxa of the third pair of pereopoda (or fifth pair of legs), that can, we think, only be interpreted as a branchial organ similar to those which exist in the Amphipoda attached to most of the legs. Again, in Amphipoda, the heart lies beneath the dorsal surface of the body, in the Isopoda in the tail. In *Tanais* and *Apseudes*, according to Dr. Fritz Müller, the heart is situated as in the Amphipoda. And in the embryonic condition the development is after the manner of the Amphipoda rather than that of the Isopoda.

We restrict this group to the typical genera of Dana's sub-order *Anisopoda*. It also corresponds with Dr. Milne Edwards' ASSELOTES HÉTÉROPODES, to which we have added the family of ANTHURIDÆ.

This group, in consequence of the variation in habits, we have divided into two tribes, VAGANTIA and SUB-PARASITICA.

Tribe—VAGANTIA.

THE non-parasitic aberrant crustacea are distinguished from the sub-parasitic ones not only by their different condition of life but also by their having fully developed gnathopoda (and consequently possessing seven pairs of legs), of which, at least, the anterior pair is of a large size and more or less cheliferous.

They form two families, *Tanaidæ* and *Anthuridæ*.

Fam.—TANAIDÆ.

THE body in these Isopods is long and narrow. The head is confluent with the first segment of the body, the eyes are more or less distinctly placed on footstalks. The antennæ vary in length. The first pair of gnathopoda, or the anterior pair of legs, are of large size and cheliferous, or terminated by a didactyle claw; the second pair are of an intermediate form, but approximating more nearly to that of the pereopoda than to that of the first pair. The eggs are borne in a sub-pectoral pouch beneath the five central segments of the body. The tail is terminated by two setaceous articulated appendages.

The family corresponds with Professor Milne Edwards' tribe of *Asellotes hétéropodes*—the *Asellota heteropa* of Latreille's *Familles naturelles*. It comprises the genera *Apseudes* (*Rhæa*), *Tanais*, *Paratanais*, and *Leptochelia*.

The last-named exotic genus is especially interesting

from the length of the antennæ (nearly equal to that of the entire body), and to the greatly elongated anterior pair of legs (nearly twice that of the antennæ). It is founded upon a minute species from the Feejee Islands, and was observed by Mr. Dana to be caprelloid in its habits, attaching itself by its hinder legs to seaweeds, and reaching out the long arms in different directions as if in search of prey. In other respects the genus is closely allied to *Tanais*, *T. Edwardsii* of Kröyer, Tidssk. iv., 1842, pl. 2, figs. 13-19, being considered by Dana to belong to the same genus. This is, however, doubtful, since, according to Fritz Müller, that species is the male of *T. Savignyi*, and it is not improbable that the female of *Leptochelia* may also prove to be a true *Tanais*, in which genus it has, indeed, been placed by Lilljeborg in his recent memoir on this family.

ISOPODA.

TANAIDÆ.

VAGANTIA.

Genus—TANAIS. (*Andouin and Milne Edwards.**)*Zeuxo.* TEMPLETON, Trans. Ent. Soc. ii. (1836).*Crossurus.* RATHKE, Nov. Acta. xx.*Anisochirus.* WESTWOOD, Ann. Sc. Nat. xxvii. (1832).

Generic character. Body elongated. Cephalon and first segment of pereion confluent. Antennæ short, subequal. First pair of gnathopoda very large, didactyle; second pair slender, simple, and assimilating to the pereiopoda. Pleon five-jointed, fourth joint short, fifth terminated by a pair of single-branched filamentary uropoda.

In the large size of the first pair of didactyle legs, and in the confluence of the head and first segments of the body, this genus agrees with *Apseudes*, but the second pair of legs are slender and simple, and the tail is terminated by two short slender appendages composed of but very few articuli. The antennæ are also short, being nearly equal in length, although the inner or superior pair are much stronger than the outer pair.

The body is small and has the sides nearly parallel. The head and first segment of the body are so closely soldered together that little or no trace of their separation is visible from above; the anterior portion of the head is produced into a point. The eyes are porrected on short footstalks, which are movable in the males, according to Fritz Müller, but which, according to Van Beneden, are completely immovable. The upper or inner antennæ are seldom so long as the head and following segment; they are straight, directed forwards and downwards, and are much thicker than the lower pair; they are formed of a peduncle which consists of three

* Résumé (not Précis) d. Ent. p. 182 (without description—1829), pl. xxix. fig. 1, "Tanais de Costa," not "Tan. Cavolini." (The reference by M. Edwards to Ann. Sci. Nat. xiii. 288, is erroneous, being intended for *Rhœa*.) Latr. Cours d'Ent. 403.

cylindrical joints and a rudimentary flagellum, which is, however, considerably elongated in some species, as in *T. Edwardsii*, where it is seven-jointed; according, however, to Fritz Müller, the sexes differ in the structure of their antennæ. A small auditory cavity exists in the first joint of the peduncle. These antennæ are attenuated to the tip, which is furnished with a strong pencil of hairs. The lower antennæ resemble the upper in direction and length, but they are more slender, and consist of a five-jointed peduncle, of which the first and third are short and ring-like, and the fifth is also terminated by a few hairs, within which is also a rudimentary flagellum. The mouth is well formed for biting. The upper lip is conical, resembling that of the *Gammari*, with a ridge along the medium line terminating in a produced point. The lower lip is formed of two ovate pieces fixed obliquely, united together at their extremity, leaving a triangular space between them, arising from a reversed triangular piece rounded at its base.* The mandibles are horny and elongate-triangular, terminated in a denticulated point rather incurved, with a deep impression and a movable denticulated tooth fixed beneath the apex; towards the base on the inner edge, is a strong somewhat squared molar tooth, truncated, and having the entire edge of the truncated part notched for chewing: in the middle of the outer edge is a small tubercle emitting a short bristle, probably representing the mandibular palpus. The inner pair of maxillæ are strong, formed of a long, curved, sub-cylindrical outer portion, with the apex truncate and spinose, and a biarticulated inner division with the tip of the second

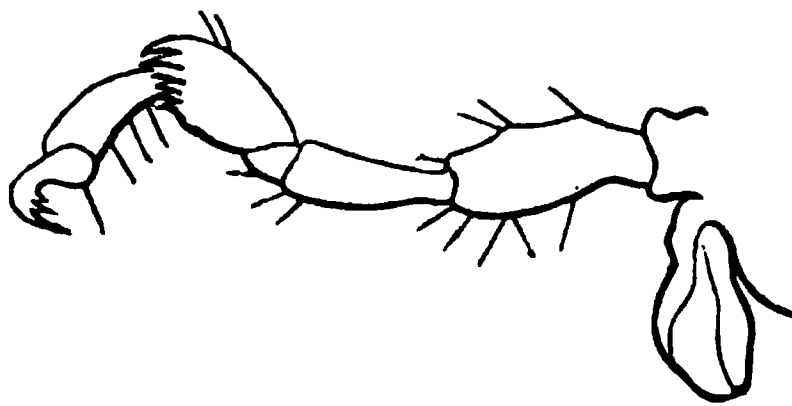
* We believe this piece, represented by Savigny as described above (and more nearly agreeing with the figure of the same organ in *Gammarus* than in *Cymothoa*), is identical with the piece described under the name of *Under-læben* by Krøyer (Tidsk. iv. 170).

joint armed with strong setæ; these two divisions are fixed upon an oblong movable basal joint. The outer pair of maxillæ, according to Savigny, consists of a pair of organs, each of which is formed of three slender oval plates lying upon each other and arising from an oblong basal joint.

The pair of foot-jaws (*g*), closing the mouth from beneath, is of large size, brought into contact with each other along the inner edge of the basal half, the first joint being nearly square, but with the base produced at the inner angle; the second joint is short, but swollen on the outer edge and produced within into a flat oval plate, ciliated along the margin; the third and fourth joints respectively are nearly triangular in form, with a strong pencil of hairs on the inner margin; and the terminal joint is slender, curved, and affixed at the apex of the preceding joint so as to rest upon its inner edge, the top and inner margin being also furnished with a long pencil of hairs. The organs of the mouth occupy nearly the whole of the under-side of the conjoined head and first segment of the body, leaving the laterally-dilated posterior angles for the insertion, on the under-side, of the base of the large first pair of legs.

The first pair of legs are not only evidently very powerful organs of prehension, but are also employed by the animal for the defence of the parts of the mouth, upon which, when unemployed, they fold very closely. They are of large size and very robust, with the wrist oblong, and the hand large and sub-ovate, set on the wrist obliquely, having the infero-anterior angle produced into a strong fixed finger, against which the movable apical finger works, forming a powerful didactyle claw. The second pair of legs are more slender than the remainder, and somewhat longer than the third pair; the segment of

the body, also, to which they are attached, is shorter than the remainder. They are simple in their structure, and terminated by a long, slender finger. The five remaining pairs of legs are also simple, and gradually but slightly thickened from the third to the seventh pair, which is the thickest. The slender membranous plates forming the incubatory pouch in the female are attached to the base of several of the intermediate pairs of legs. Fritz Müller, in his remarkable work "Für Darwin" (8vo. Leipzig, 1864, p. 11), gives a lateral view of *Tanais dubius* of Kröyer, with the second, third, fourth, and fifth pairs of legs respectively furnished at the base with a small oval plate, which he describes as the "Anlagen der blätter die später die Bruthöhle bilden."



LEG OF TANAIS.

We here give a figure of the fifth leg of *Tanais vittatus*, from the coast of Devonshire, having an appendage at its base, which we regard as a branchial sac similar to those existing in the Amphipoda, and consequently affording a proof of the nearer relationship of *Tanais* with that order than is possessed by any other isopodous animal. This appendage is wanting in some specimens, and its variable existence is probably a character of specific distinction in the group. Moreover, as we have found it in the largest-sized specimens, we apprehend it cannot be regarded as the rudiment of the plates that form the incubatory pouch, as Dr. F. Müller considers those of *T. dubius* to be.

The tail in this genus consists of less than the normal number of segments, and carries only three pairs of pleopoda and a pair of terminal uropoda. The segments may vary in development and distinctness, being more or less fused together, in the different species. In one or more species (constituting the genus *Crossurus* of Rathke) two of the segments are furnished on the upper surface with transverse fascicles of long hairs, and on the under-side with two pairs of delicate oval membranous plates, strongly ciliated, supposed by Edwards to constitute the breathing apparatus, but into which F. Müller affirms not a single blood corpuscle ever enters. Each pair of these plates is fixed upon a common base, and is laid transversely when at rest, thus differing from the general arrangement of these organs.

The terminal segment of the body is furnished at the sides with a pair of short, slender, articulated, filamentary appendages, consisting, in *T. Savignyi* and *T. Edwardsii*, of a strong basal joint followed by a six or seven jointed flagellum, at the base of which is affixed a minute oval appendage setigerous at its tip. In the species which we have figured this appendage consists of only three or four distinct joints.

As yet we are but imperfectly acquainted with the characteristics of the species as well as with the distinction of the sexes, habits, &c. The typical species (*Gammarus Dulongii*, Andouin) was from Egypt, and is beautifully illustrated by Savigny in the great work on that country. In Kröyer's monograph of the genus, published in the fourth volume of the "Naturhistorisk Tidsskrift," seven species are described, namely, *T. Edwardsii* and *Savignyi* from Madeira, *T. dubius* from Bahia, in Brazil, *T. gracilis* from Spitzbergen, *T. tomentosus* from the Norwegian Sea, and *T. Örstedii* and *T. Curculio* from Öresund. The

last four species are described in detail in the second series of the same work (vol. ii. p. 408).

In a paper on the structure and relations of the genus by Fritz Müller (Archiv. f. Naturg. 1864, p. 1—) the author is, however, induced to consider that *T. Edwardsii* and *Savignyi* are the sexes of the same species, and that *T. curculio* and *Örstedii* are in the same condition.

From the various localities in which the different species have been found, we presume that they were taken at large by dredging, and consequently are not parasitic in their habits. Van Beneden, however (who has published some observations on the genus in the fifth volume of the second series of the "Bulletin of the Académie Royale de Belgique," as also in his "Recherches sur la faune littorale de Belgique," Crust. p. 93, pl. 16b, where he has given a rude figure and details of *T. Dulongi*), states that he obtained a male and five females of that species from the carapace of a *Chelonia mydas*, thrown upon the shore near Ostend, which would indicate a carnivorous condition of life for that species.

In a memoir on the relation which this genus holds to the order of Isopoda,* Prof. Lilljeborg unites in this genus not only *Crossurus* of Rathke, but also *Paratanais* and *Leptochelia* of Dana. By so doing he finds himself compelled to commence by separating that division of the genus which carry two branches to the posterior pair of pleopoda from those that carry but one. We think that it is more convenient, in our present state of knowledge, to keep apart as much as possible animals possessing a marked structural distinction. We therefore retain in this work Dana's genus of PARATANAIS.

* Bidrag till Kännedomen om de inom Sverige och Norrige före Kommande crustaceer af Isopodernas underordning och Tanaidernas familj. Af Wilhelm Lilljeborg. Upsala 1864.

ISOPODA.

TANAIDÆ.

ABERRANTIA.



TANAIS VITTATUS.

Specific character. Body rather short, with the segments of the pleon clothed with transverse fascicles of long fine hairs. Superior antennæ thicker and longer than the inferior, three-jointed, setose at the tip. Cephalon and first segment of the pereion mottled with dark lines, forming oval patches; second pair of gnathopoda shorter than the following, several of the posterior pairs of legs terminated by a sickle-shaped finger, with a tooth at the middle of its inner edge, and serrated along the base.

Length two lines and a quarter.

- Crossurus vittatus.* RATHKE, Nov. Act. 20, pl. i. fig. 7.
Tanaïs vittatus. LILLJEBORG, Bidrag till Kännedomen om de inom Sverige och Norrige Förekommande crust. af Isop. underord. och Tanaid. famil. p. 24. 1864, Upsala.
Tanaïs de Costa (?). ANDOIN and EDWARDS, Résumé d'Entomologie, t. i. pl. xxix. fig. 1.
Tanaïs Cavolinii (?). EDWARDS, Hist. Nat. Crust. iii. p. 141, pl. xxxi. fig. 8.

NOTWITHSTANDING the Gulf of Naples is given by Professor Milne Edwards as the habitat of *T. Cavolinii*,

we have but little hesitation in referring to it the specimens from the South Coast of England, Berwick Bay, and Glasgow, agreeing as they do with a specimen in the Hope Collection at Oxford, bearing the label of that name in the handwriting of, and most probably collected by, Signor Costa, in the Bay of Naples.* There are, however, several characters in which our specimens agree so closely with those described below under the name of *Paratanais Dulongii*, that we should not be surprised if it should be ascertained that (notwithstanding the remarkable clothing of the basal segments of the tail) these individuals should prove to be the females of the former. We were at first, indeed, disposed to regard these specimens as being the *T. tomentosus* of Kröyer, from the Norwegian Sea, but that species is described as having "omnes fere corporis partes pilis longissimis crispis obsitæ," which is certainly not the case with our specimens. It must, however, be observed that some of our specimens of large size are entirely destitute not only of the ventral scales forming the incubatory pouch, represented by Rathke and Müller, but also of the appendages alluded to above as representing the branchiæ according to Mr. Spence Bate.

The general proportions of the animal agree with those of *T. Dulongii*, except that the body is comparatively somewhat more robust. The head is broader than in *T. Dulongii*. The relative size of the two pairs of antennæ are shown in the above woodcut, the upper pair having a slight rudimental flagellum concealed among

* In his description Prof. M. Edwards describes the three first segments of the abdomen as "tres pilos lateralement," but the rudeness of his figure leads us to infer that the hairs extend to the dorsal surface of those segments.

the base of the terminal setæ. The lower antennæ are shorter and more slender than the upper, apparently four-jointed, the second joint being short, the three others of nearly equal length, but gradually becoming more attenuated towards the tip. The foot-jaws resemble those of *T. Dulongii* (in our figure the dilated inner plate of the second joint is omitted, having been lost in dissection). The fore legs are very large, strong, smooth, and polished, the hand produced at its lower angle into a strong immovable finger, having a very small obtuse tubercle near its base and another beyond the middle, the intervening space being filled up by a thin portion of the edge. Several of the terminal pairs of legs are furnished with a strong sickle-shaped finger, having a tooth at a little distance beyond the middle of the inner edge, the space between it and the base being denticulated. In the individuals which we have examined the under-side of the body is not furnished with the incubatory pouch, nor with the short appendages observed at the inner base of one or more pairs of the legs. In others, however, as represented by Rathke, the bilobed incubatory pouch is of large size, occupies the under surface of the intermediate segments of the body, and consists of very transparent membranes, allowing the eggs to be distinctly perceived from beneath; its position and appearance indicated in our woodcut being copied from Rathke's figure. The most striking character of the species, however, consists in the very dense pencils or fascicles of long thin hairs with which the upper surface of the second and third segments of the tail are clothed, and which are set on at right angles to the body. The terminal segment of the tail is slightly notched in the middle of the under surface of its posterior margin, and is furnished at its sides with a pair

of short triarticulated filaments, resembling the superior antennæ in structure, and possibly performing similar functions.

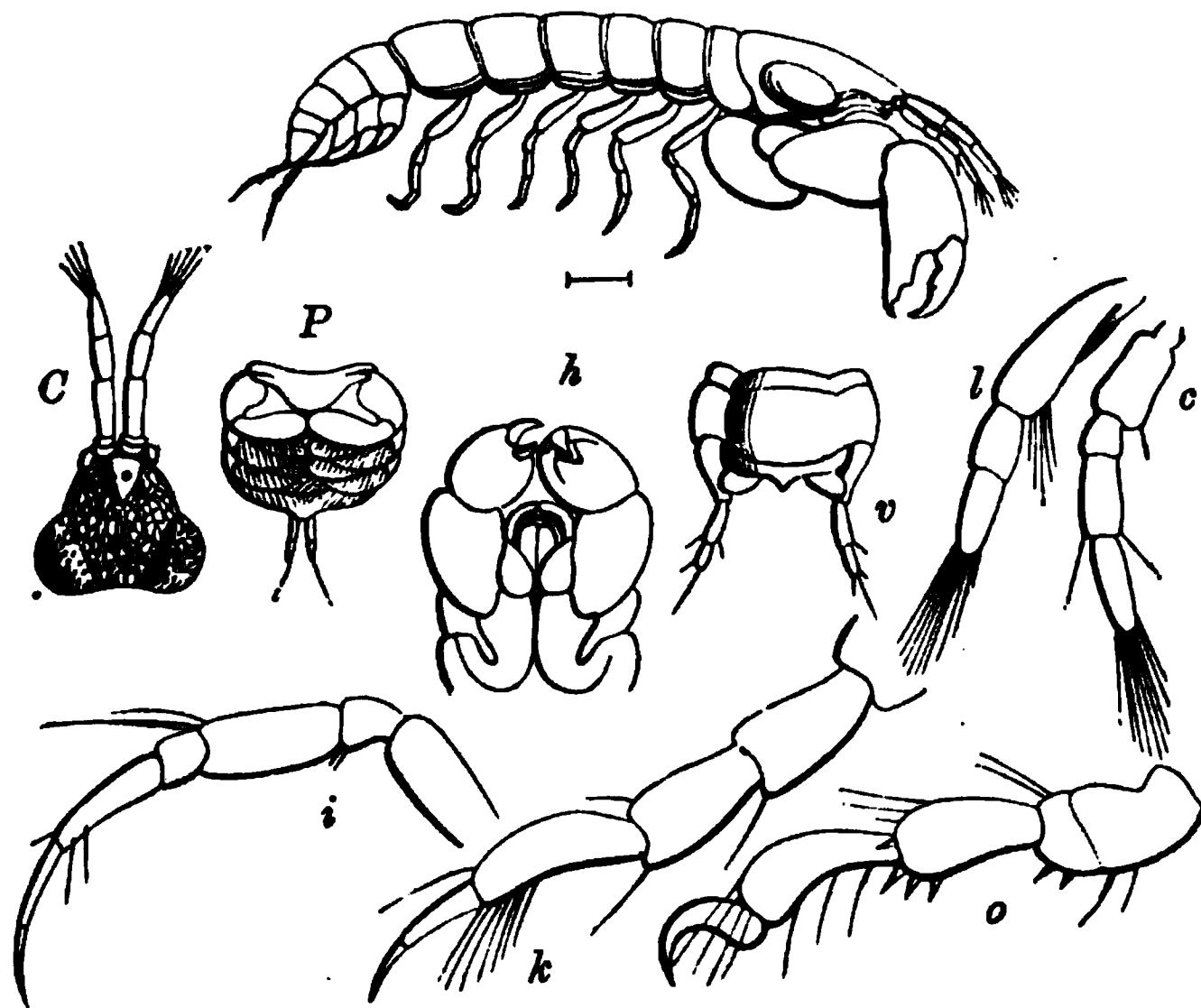
We have received specimens of this species from Berwick Bay, captured by our late friend Dr. George Johnston, also from Mr. David Robertson, of Glasgow; as well as a considerable number of individuals captured by Mr. Loughrin, at Polperro, who informs us that they live gregariously below high-water mark, where they protect their small colony by retiring deeply within the fissures of the slaty rocks of the coast, where they collect together a mass of material of a "leathery consistence," behind or within which they take shelter. When disturbed they escape, and will spring to a considerable distance. This is probably done by bringing the head and tail together and suddenly straightening themselves.

Among the several specimens sent to us by Mr. Robertson, was one of a very slender form; so peculiar was it that we figured it under the impression that it was of a separate species from the present, and named it in the dredging list as *T. hirticaudatus*.* But among the hundreds that we have had the opportunity of examining from several localities, we could identify many that were intermediate between the two extremes, and consider it not improbable that the slender form is but a specimen that had recently cast its skin.

* Brit. Assoc. Rep. 1860, p. 225.

ISOPODA.
ABERRANTIA.

TANAIDÆ.



TANAIS DULONGII.

Specific character. Body smooth. Pleon destitute of fascicles of hairs. Antennæ subequal in length, the upper pair much thicker than the inferior. First pair of gnathopoda very robust; second pair slender, and rather longer than the pereiopoda. Third pair of pereiopoda with an appendage at the base within: tail short, obtuse, terminal appendages short, three-jointed.

Length not quite a $\frac{1}{4}$ of an inch.

Gammarus Dulongii (?)

ANDOUIN, Explicat. Pl. Egypte, t. xi. fig. 1.*

Tanaïs Dulongii (?)

MILNE EDWARDS, Crust. iii. p. 142. W. THOMPSON, in Ann. Nat. Hist. xx. p. 245. WHITE, Cat. Brit. Crust. p. 68? Pop. Hist. Brit. Crust. p. 227?

Anisochairus Dulongii (?)

WESTWOOD, Annales Sci. Nat. xxvii. p. 830.

THE type of this species, originally figured by Savigny, was a native of the coast of Egypt; it is, therefore, with some doubt that we affirm its identity with speci-

* Our outline figures P and v are copied from Savigny's plate.

mens from the coast of Devonshire which have served for our work, although the general resemblance is so great that we prefer to consider them as belonging to that rather than to any of the species described by Kröyer. The species has indeed been recorded, without any expression of doubt, as a native of the Irish coast by the late W. Thompson, Esq., but the specimens which were so regarded by him prove on examination to be mutilated specimens of an amphipodous crustacean. Some differences, however, exist between our specimens and Savigny's figures of the terminal portion of the body, which we are inclined to regard as arising from inaccurate drawing on the part of Savigny rather than as really existing.

The body is of moderate length, smooth, and destitute of hairs, especially on the segments of the tail. The upper antennæ are strong, porrected, and nearly as long as the large following segment; they are composed of three joints, of which the basal is the largest and terminated by a pencil of hairs. The lower antennæ (represented too highly magnified in figure *c*) are rather shorter and more slender than the upper pair, and five-jointed, having a very short basal and a short third joint, the fifth joint terminating in a few hairs. The large first pair of legs are terminated by a didactyle claw, of which the immovable finger is strong and truncated along its inner edge, which is slightly denticulated, whilst the terminal movable finger is slightly serrated along its inner edge. The second pair of legs are rather longer and more slender than the third pair, the five remaining pairs being nearly equal in size. The second pair of legs are gradually attenuated to the tip, the finger being slender, acute at the tip, and but slightly bent. In the third pair the terminal joints are wider; the fifth

pair are furnished at the base on the inside with a small movable appendage, which we consider as being the homologue of the branchial organ of the amphipodous crustacea; the two hinder pairs are more robust, and better fitted for prehension, with the fingers strong and hooked. The tail is short, scarcely longer than wide, and terminated by two short slender three-jointed filaments.

The only individuals which we have seen of this species were sent to us from Polperro by Mr. Loughrin.

ISLE OF PORTLAND, FROM THE NOTHE, WEYMOUTH.

ISOPODA.
ABERRANTIA.

TANAIDÆ.

Genus—LEPTOCHELIA.

Leptochelia. DANA, U.S. Explor. Exped. p. 800.

Tanais, pars. KRÖYER, Nat. Tidssk. vol. iv. LILLJEBORG, Bidrag till Kännedomen om de inom Sverige och Norrige förekommande Crust. af Isopod. underord. och Tanaid. fam. p. 25.

Generic character. Animal long and slender. First segment of pereion fused with cephalon, the following six segments subequal. Pleon consisting of six separate segments. Eyes pedunculated. Superior antennæ long, and terminating in an articulated flagellum. Inferior antennæ very short. First pair of gnathopoda long and chelate; "fingers slender and gaping" (DANA); second pair slender, feeble, and terminating in a long styliform dactylos. The five pairs of pereiopoda subequal in length, the three posterior pairs having the bases somewhat more robust than the two anterior pairs. Pleopoda, five anterior pairs, biramose; posterior pair unibranched and multiarticulate.

THIS interesting genus holds an intermediate position between *Tanais* and *Paratanais*. It agrees with the former in the general contour of the body, and with the latter in the form of the second pair of gnathopoda as well as of the pereiopoda. The pleon has five distinct segments, each carrying a pair of pleopoda, as in *Paratanais*, but it has only a single branch to the caudal pair of pleopoda attached to the sixth segment. The antennæ are somewhat abnormal, since there is no distinguishable peduncle. The superior pair have the first joint long and robust, the second not half as long as the preceding, the third and every successive joint is still shorter than the preceding, so that unless the first two joints of the peduncle be fused together, it is difficult to

determine the limits of that portion of the peduncle.* In the inferior pair the difficulty is still greater, for there are but five joints, the last being very rudimentary. In this respect this pair resembles that of the genus *Tanais*. The first pair of gnathopoda are very long, as long as (or much longer than) the superior pair of antennæ. In both the species known, they have a large gaping chela, which Mr. Dana considers as a generic distinction, but which we think is very liable to specific variation.

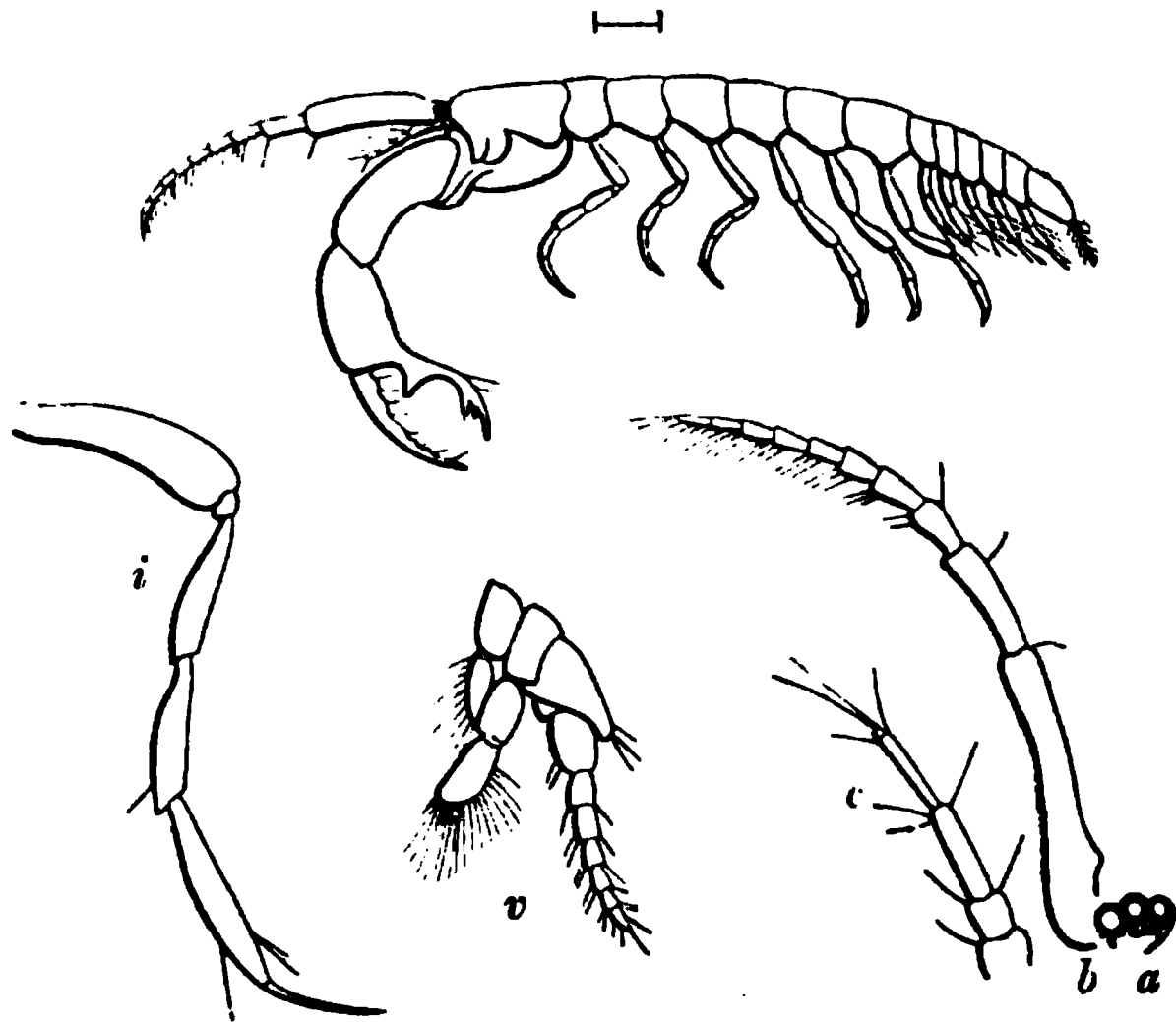
The only species hitherto referred to this genus is *Leptochelia minuta*, found among sea-weed and small corals in the Island of Ovalan, one of the Feejee group, the length of which is only one-tenth of an inch.

* In the typical species described by Dana, the first joint is a very minute basal one, and the second very long.

ISOPODA.

ABERRANTIA.

TANAIDÆ.



LEPTOCHELIA EDWARDSII.

Specific character. Superior antennæ half the length of the animal; inferior antennæ not so long as the basal joint of the superior. First pair of gnathopoda long, robust, with gaping chela, having the infero-digital process armed with two strong blunt teeth. Posterior pair of pleopoda short, being less than half the length of the pleon.

Length $\frac{1}{8}$ inch.

Tanais Edwardsii. KRÖYER, Naturh. Tidsskr. iv. 181, pl. ii. figs. 18-19.
DANA, U.S. Expl. Exped. p. 800.

THE animal is slender and linear. The head is fused with the first segment of the body, the six following segments subequal, the anterior being somewhat the smallest. The tail consists of six segments, of which the last is rather the longest and terminates in an obtuse apex. The eyes are small, round, consisting of six or seven rather large lenses, and planted on a small peduncle placed in front of the anterior margin of the cephalon, which, however, partly covers it. The superior pair of

antennæ are about half the length of the animal, and consist of one long basal joint exceeding one-third of the whole length of the organ; the second is scarcely half the length of the first, and is followed by a series of eight small joints, each succeeding one being shorter than the preceding. These eight small articuli are furnished on the under side with bundles of those membranous hairs which we have generally considered as being connected with the acoustic apparatus, and therefore named *auditory cilia*, but which Dr. V. Herisen, who has given much attention to the subject, considers as having nothing to do with the sense of hearing. The two basal joints of this organ have not these appendages, hence we think that they alone represent the three joints of the normal peduncle. The inferior pair of antennæ are very short, reaching but little beyond half the length of the basal joint of the superior pair. They are small, slender, and feeble organs, generally directed obliquely downwards, and consist of five joints, the first two of which are robust and short, the two succeeding long and slender; the apical one minute and rudimentary. They are furnished with a few long slender hairs. The first pair of gnathopoda are large, strong, very long, being about two-thirds the length of the entire animal, and reaching beyond the extremity of the antennæ; the three basal joints appear to be without the power of articulation, which exists most freely between the meros and the carpus; the carpus reaches quite to the extremity of the basal joint of the superior antennæ; the propodos is longer than the carpus, and with the dactylos forms a large, gaping, pincer-like claw; the infero-digital process of the hand is curved, and armed with two strong tubercular teeth; the dactylos is also curved and feebly serrated, a minute hair springing from the anterior

surface of every denticle. The second pair of gnathopoda are but half the length of the first, being slender, very feeble, and terminating in a slightly curved styliform dactylos. The first two pairs of pereopoda are formed nearly like the second pair of gnathopoda, but have shorter, therefore stronger, dactyla. The three posterior pairs of pereopoda are reversed from the preceding in their mode of attachment, and have the basal joint more robust than that of the preceding pairs of pereopoda; in other respects they resemble them in form. The five anterior pairs of pleopoda are alike in size and shape; they consist of a stout peduncle on each side, and carry a pair of oval, membranous plates, ciliated with long and strong hairs upon the outer and inferior margins. The inner plate, if we may judge from observation after death, is carried at right angles with the outer, which rests pendant in the water. The posterior or caudal pair of pleopoda consist of a single multiarticulate branch, of which the basal joint is larger than the terminal ones: it consists of nine or ten small articuli.

We are indebted for this interesting addition to our British Fauna to the zeal and research of the Rev. A. M. Norman, who took it during the summer of 1865 among *Zostera* between tide marks in Belgrave Bay, Guernsey.

The distinction between this and Dana's Feejeean species exists in the latter having longer superior antennæ, as also more slender and longer gnathopoda, which are only armed with a small rudimentary tooth on the inner surface near the extremity of the fixed finger of the great claw; the posterior pair of pleopoda are also longer, being described by the author as equal to the pleon in length.

. ISOPODA.
ABERRANTIA.

TANAIDÆ.

Genus—PARATANAIS. (*Dana.*)

“ Like Tanais in having the anterior feet stout and short, and the antennæ without a flagellum. Caudal stylets two-branched, branches unequal, one or many jointed.”

DANA, U.S. Explor. Exp. p. 798.

THE above is Dana's short description of this genus, which, being founded on a specimen taken in the Sooloo Archipelago, we have only an opportunity of knowing through the author's description.

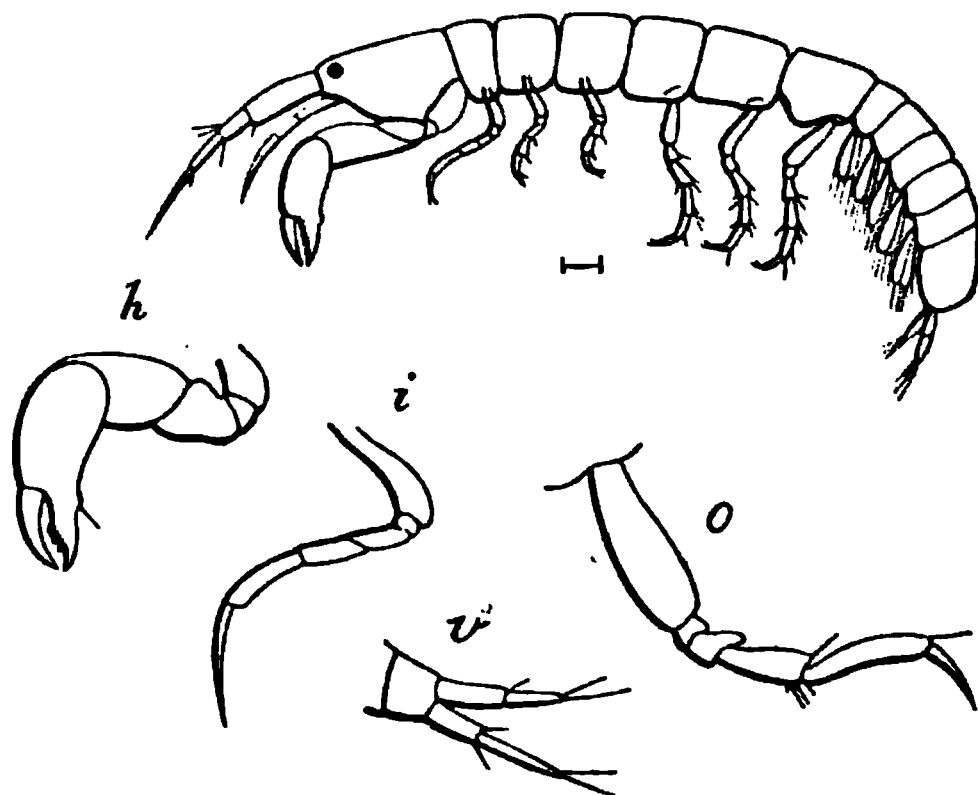
There are some important points in which our British specimens differ from the above description, but they appear to be rather omissions than structural differences.

We therefore give our own character of the genus founded on British specimens.

The cephalon is fused with the first segment of the pereion. The eyes are pedunculated. The antennæ have rudimentary flagella; the inferior pair is more slender than the superior. The first pair of gnathopoda are robust and chelate; the second feeble and monodactyle. The pereiopoda subequal in height and resembling each other in form. Pleon having six distinct segments supporting six pair of pleopoda, five being double ovate plates with ciliated margins adapted for swimming, the sixth forming a pair of biramose substyliform terminal uropoda.

ISOPODA.
ABERRANTIA.

TANAIDÆ.



PARATANAIS FORCIPATUS.

Specific character.—Body moderately long and slender. Pleon much longer than broad. Legs short. First pair of gnathopoda serrated along the inner margin of the digital process of the propodos; second pair of gnathopoda resembling, but longer than, the pereopoda. Upper antennæ much thicker and longer than the lower pair. Tail terminated by a pair of short, double-branched, two-jointed filaments, setose at the tip.

Length one line and a half.

Tanaid forcipatus.

LILLJEBORG, Bidrag Isop. Tanaid. fam. p. 25.

Tanaid Savignyi.

GOSSE, Mar. Zool. i. fig. 246 (but not of KRÖYER, Nat. Hist. Tidssk. iv. pp. 168, 181, pl. xi. fig. 1—12).

Zeuxo Westwoodiana? TEMPLETON, Trans. Ent. Soc. Lond. ii. 203, pl. xviii.

THE eyes are planted on peduncles and terminate in an obtusely pointed apex. The inferior antennæ are shorter and more slender than the superior, but scarcely so much as represented in our figure.

The first gnathopoda, or chelate appendages, have the hand armed with three or four small serratures or sharp-pointed denticles, situated on the distal half of the inner margin of the digital process of the propodos. The second has the hand long and slender, the finger forming

an exceedingly long, delicate, tapering, hair-like point. The third and fourth pairs of appendages somewhat resemble the second, but the fingers, though fine and sharp, are not so long and hair-like. The three posterior pairs of legs are reversed, and have their dactyla short and curved. The posterior pair of pleopoda are biramose, both branches being nearly of the same length, and both two-jointed.

The more elongated form of the body, and especially of the tail, the short legs, and the short, double-branched, two-jointed appendages of the tail, distinguish this species from its congeners. Its small size would, however, seem to indicate an animal not yet arrived at full size, and which, when fully grown, might probably afford less evident distinctive characters. It is proper to observe, however, that the *Tanaïs Savignyi* of Kröyer is furnished with a pair of seven-jointed filaments at the sides of the tail, the basal joint being much thicker than the rest, and furnished at its inner extremity with a short ovate appendage, setose at the tip, about half the size of the second joint. We were at the first inclined to consider, from its elongated form, that it was identical with *Zeuxo Westwoodiana* of Templeton, but not only is that species represented as having a six-jointed pair of anal filaments, but the antennæ are nearly equal in length. In other respects the species seem identical.*

The upper antennæ are considerably thicker and somewhat longer than the lower, and composed of three joints gradually diminishing in thickness to the tip, the first being as long as the two others united, and the

* Since the above woodcut was prepared, we have received from the Rev. A. M. Norman a specimen, captured among *Zostera* between tide marks in Belgrave Bay, Guernsey, which has a pair of six-jointed anal filaments with a short one-jointed secondary filament arising from the extremity of the basal joint. Can this be the female of *Leptochelia Edwardsii* fully grown?

extremities of all the joints furnished with a few hairs. The lower antennæ are four (? five) jointed and slender. The second pair of legs are slender, and longer than the following pair, with the terminal finger long, very slender, and slightly bent. The third and fourth pair of legs are very short, and the three posterior pairs longer and stronger. The tail nearly occupies one-third of the whole length of the animal, the six segments of which it is composed being distinct; the five basal ones transverse, and the terminal one rounded at the extremity, which is furnished with a pair of biramose biarticulated filiform appendages, slightly hairy at the extremity of the joints.

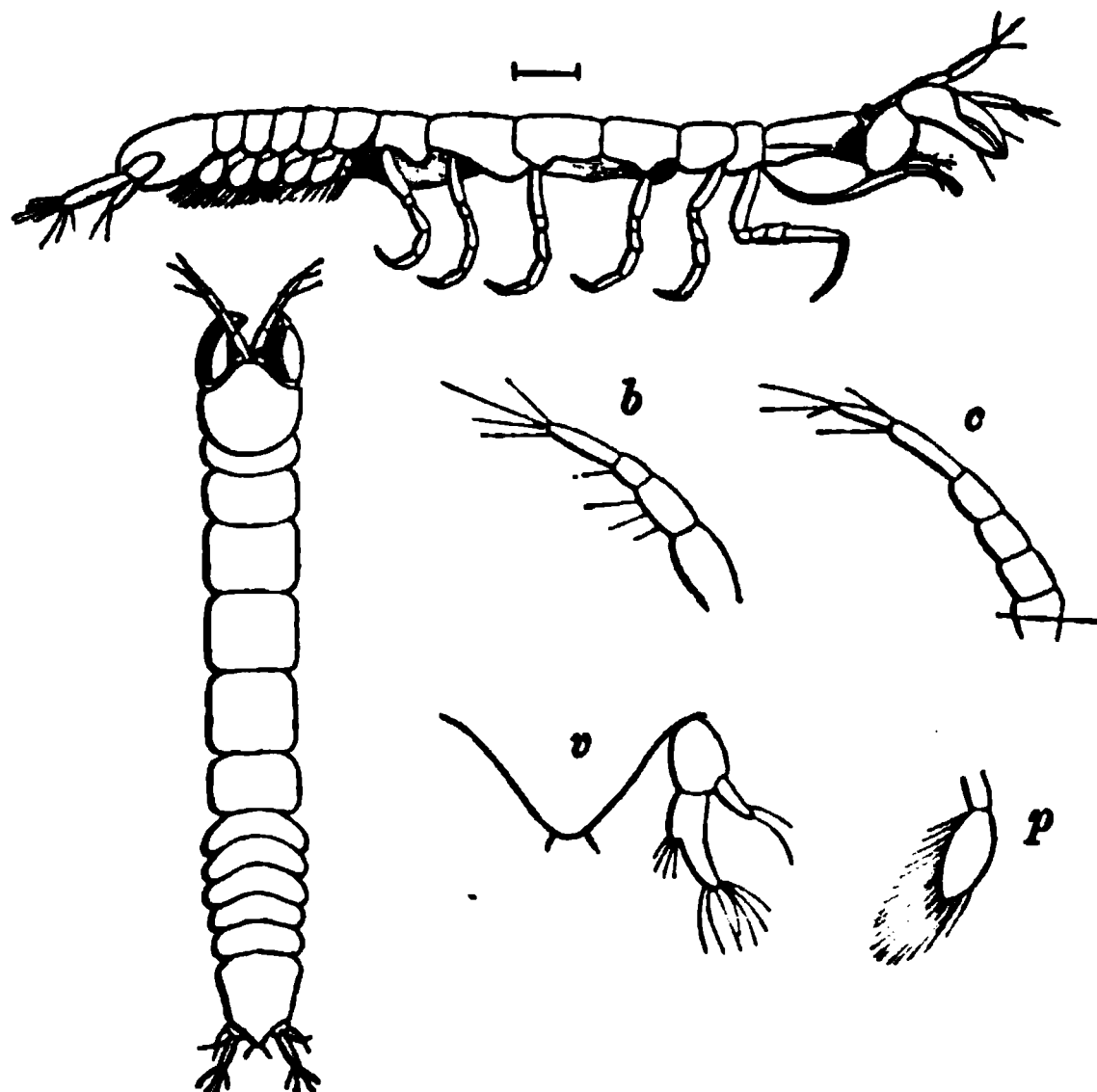
The first specimen of this species that we obtained we dredged in Plymouth Sound. It was very small, and possessed but six segments to the pereion, and consequently wanted one pair of legs. We therefore assumed it to have been that of a very young animal. We have since, from our valued correspondent Mr. Edward, of Banff, obtained two others of larger size, and with the normal complement of limbs, all the other features being persistent, a circumstance that induces us to believe that our description represents the character of an adult animal.

We are compelled to adopt this conclusion, from its difference from *Tanais*, its nearest ally, both in the form of the second pair of gnathopoda, the number of pleopoda developed as swimming appendages, and the biramose condition of the posterior pair of pleopoda.

ISOPODA.

TANAIDÆ.

ABERRANTIA.



PARATANAIS RIGIDUS.

Specific character.—Body narrow. Margins of the pereion and pleon parallel, pleon terminating in a central point. Antennæ not longer than the cephalon. Posterior pleopoda having both rami uniarticulate, the outer being half the length of the inner.

Length $\frac{1}{8}$ th of an inch.

THE form of this species is slender and cylindrical, the sides running parallel with each other from the outer angle of the anterior margin of the head almost to the posterior pair of pleopoda. The cephalon is confluent with the first segment of the pereion, and both together form a segment that is scarcely longer than broad. The second segment of the pereion is very short; the third is about three times as long as the second, and both together about as long as the cephalon; the fourth segment is quadrate, and as long as the two preceding; the fifth is a

little longer than the fourth, but about the same length as the sixth, while the seventh is about half the length of the sixth.

The pleon has the first five segments subequal, but the sixth or terminal is quite as long as two of the preceding, and terminates in a central point that is furnished with a solitary hair upon each side of the apex.

The eyes are small and not easily recognized. The antennæ are short, the superior being more robust and slightly longer than the inferior, and tipped with a few cilia; in length they equal that of the cephalon and first joint of the pereion, which being fused together form the head. The superior antenna consists of four joints, that is, a peduncle of three and a uniarticulate flagellum, but which is more slender and longer than the last joint of the peduncle. The inferior antenna appears to terminate in a similar uniarticulate flagellum. The first pair of gnathopoda are long and robust, of which the hand is not larger than the rest of the limb. The carpus is as long as the propodos, and the dactylos is long, curved, and slender, forming with the digital process of the propodos, against which when closed it impinges closely through its entire length, a sharply-pointed and somewhat elongate chela. The second pair has the dactylos long and slender, being hair-like at its extremity and slightly curved; the remaining pairs of legs, the true pereopoda or walking legs, are subequal in length, of somewhat slender and feeble proportions, and terminate in small curved dactyla. The five anterior pairs of pleopoda are pedunculated and liberally ciliated on the outer and posterior margins. The posterior pleopoda are biramose, the inner branch being rather shorter than the ultimate segment of the pleon; it is single-jointed, but furnished near the middle, on the inner side, with a small pro-

tubercle armed with two or three minute cilia, and carrying at the extremity five long and strong hairs. The outer ramus is about half the length of the inner, single-jointed, armed near the middle of the outer margin with a single hair, and also with a second solitary hair on the outer side of the apex.

The species bears a near resemblance to that described by Lilljeborg under the name of *Tanais brevicornis*.

Lilljeborg describes that species as having the inner ramus of the posterior pair of pleopoda biarticulate, whereas in this it is uniarticulate, but the small ciliated protuberance near the middle of the inner margin, together with the circumstance that from that point a slight bend or change of direction takes place, may have suggested the idea of a second articulation to the author of that species, as it was a question which we could not determine until we had treated the specimen with "*liquor potassæ*."

So well, otherwise, does this animal correspond with Lilljeborg's description, except in the number of joints of the upper antenna, that had it been described by any less experienced observer, we should have considered the two as belonging to the same species, assuming that the points in question had been misinterpreted.

The only specimen that we have seen of this species was sent to us by Mr. Robertson, of Glasgow, who "dredged it at the roots of *Laminaria saccharina*," near Cumbrae.

ISOPODA.

ABERRANTIA

TANAIDÆ.

Genus—APSEUDES.

Apseudes. LEACH, in Brewster's Edinb. Encycl. vol. vii. p. 404, 1812.
EDWARDS, Hist. des Crust. t. iii. p. 138, 1830. LILLJEBORG,
Bidrag. kan om de inom Sverige och Norrige förekr. Crust. af
Isop. Tanaid. fam. p. 8, 1864.

Eupheus. RISSO, Hist. des Crust. des Nice, p. 124, 1816.

Rhæa. MILNE EDWARDS, Ann. Sci. Nat. xiii. p. 292, 1828.

Generic character.—Body elongated. Head and first segment of the pereion confluent. Upper antennæ longer than the lower, with the first joint of peduncle long and robust, the flagellum consisting of two elongated articulated filaments. First pair of gnathopoda chelate; second pair having the propodos transversely dilated. Pleon terminated by a large segment bearing two long and two short slender filaments.

THE head and first segment of the body are confluent, the former advanced in front into a point, forming a small triangular rostrum, the latter having the sides dilated and depressed. The eyes are large and borne on movable footstalks. The upper antennæ are robust, the first joint especially being long and stout; the flagellum or terminal portion is multiarticulated, and provided at its base with a slender secondary filamentous appendage composed of numerous articuli; the lower antennæ are shorter and more slender, furnished with a small squamiform movable process, as in the Macrourous stalk-eyed crustacea, and terminate in an articulated and gradually attenuated flagellum. The mandibles are small, slightly truncate, denticulated at the extremity, and furnished with a three-jointed palpiform appendage. The outer foot-jaws are confluent at the base, and terminated by three flattened joints strongly ciliated.

The first pair of legs are robust, terminated by a strong didactyle hand. The second pair, though smaller than the first, are more robust than the following, being flattened and terminated by a broad hand-like joint, more or less palmated; the penultimate joint (propodos), having a small movable finger (dactylos); the five following pairs of legs are slender and simple. The five segments of the tail are short, but the last (sixth segment) is elongated, and terminated by a rounded plate (the telson), on each side of which is placed a flattened appendage, terminated by one long and one short very slender filiform branches, being the representatives of the last pair of tail-feet. The five anterior segments of the tail are respectively furnished with a pair of appendages, each consisting of a basal stem supporting two delicate foliaceous plates strongly ciliated along their margins. The eggs are borne in a semi-transparent pouch beneath the breast, which extends from the second to the sixth segment of the body.

This is one of the most interesting genera of crustaceous animals. In some respects, such as the form of the eyes, the articulated filament attached to the upper-, the squamiform process of the lower- antennæ, and the cheliferous anterior feet, we perceive a relationship to the macrourous stalk-eyed order of Crustacea; in other conditions it assimilates the Amphipoda, in which order Professor Milne Edwards was at the first disposed to place it, although he subsequently referred it to the *Isopodes Idoteides* (Encyclop. portatif. p. 182; Ann. Sci. Nat. 1830, August), induced to this step by the structure of the breathing apparatus, which he attributed to the under side of the segments of the tail; whilst the soldering of the head and first segment of the body, and the podophthalmous structure of the eyes, induced

Dr. Fritz Müller (Archiv. f. Naturg. Jahrg. 1 Bd. p. 1) and Van Beneden (Ueber der Bau der Scheerenasseln Assellotes Heteropodes M. Edw.) to attribute it to the *Macrourous Decapods*, each basing his opinion, arrived at independently, upon the supposition that the union of the head with the first joint of the body is an incipient effort in the development of a carapace—the latter author, moreover, asserting that respiration is carried on beneath the carapace, although he states that he has not been able to detect any especial organ adapted to that purpose.

From this view of the question we must entirely dissent, first, because the branchial organs in decapod crustacea are essentially appendages of the coxæ or first joints of the limbs attached to the pereion or pleon: consequently, all these limbs being posterior to the cephalon, the organs of respiration cannot be developed beneath it; second, because the carapace is not developed by a fusion of the segments of the pereion with those of the cephalon, but by a monstrous production of the integument of the latter extending back, over, and covering the segments of the former; and so, in the typical decapoda, overlying and protecting the segments of the pereion, and consequently the branchial organs also.

This genus also approaches towards the *Podophthalmous crustacea*, and more particularly the Macrourous order, in the form of the eyes and inferior antennæ, whilst it resembles the *Amphipoda* in the character of the legs and the general slenderness of the body. It also approaches the *Squilla* in the character of the pleopoda, and the *Isopoda* in that of the posterior pair of pleopoda.

One interesting and, as far as we know, unique feature in these crustacea yet remains to be noticed. The segments of the pleon have the lateral walls (long known as the

epimera of Milne Edwards, called also the pleura by many authors) existing as articulated appendages, demonstrating two important features in the homologies of these parts: first, that they are really portions of the appendages, being the first joint or coxæ of the pleopoda, as first observed by Mr. Spence Bate in his report on the Amphipoda; and second, that since the peduncle consists of three joints, the second branch in the appendages of the pleon, as in other parts, is shown to take place invariably at the extremity of the third joint.

Of this genus we regret that we have obtained but few specimens, too few, indeed, to have enabled us to make complete dissections of the animal.

As yet we know not the form of the male animal; it may be similar to that which we figure as the female, but had not Müller, Rathke, and Lilljeborg described the females of *Tanais* as resembling the male, we should have suggested that these species were females of *Tanais*, for it is a singular fact that although of the latter genus we have examined some hundreds of individuals, we have never yet seen one possessing the features of a female.*

* We are bound, however, in this place to recall attention to Rathke's figure of his *Crossurus vittatus* with a large incubatory pouch filled with large eggs.

ISOPODA.

ABERRANTIA.

TANAIDÆ.

APSEUDES TALPA.

Specific character. Front of cephalon terminating in a projected point, its dorsal surface irregular. Body finely but sparsely setose. Pleon very hairy at the sides. Terminal segment of the pleon long and slender. First pair of gnathopoda large; the carpus with two lobes on the under edge. Palm of the propodes with a tooth in the middle; dactylos with a tooth at its base.

Length one-third of an inch.

- Cancer (Gammarus) Talpa.* MONTAGU, Trans. Linn. Soc. ix. p. 98, t. 6, f. 6.
Apsudes Talpa. LEACH, Edinb. Enc. vii. p. 404. Trans. Linn. Soc. xi. p. 372. Suppl. Enc. Brit. i. p. 428. SAMOUILLE, Ent. Compend. p. 109. LAMARCK, Hist. Nat. Anim. sans. vertebr. v. p. 290. MILNE EDWARDS, Crust. iii. p. 140. CUVIER, Règne An. Edit. Crochard Crust. pl. 62, fig. 1. WHITE, Brit. Mus. Cat. Brit. Crust. p. 67. Pop. Hist. Brit. Crust. p. 226. GOSSEN, Man. Mar. Zool. i. fig. 245.
Eupheus Talpa. DESMAREST, Cons. Crust. p. 285, t. 46, fig. 9.

THE figure of this species, published originally by Montagu, and which has been copied by all subsequent authors (except Prof. Milne Edwards), was so ill drawn, that the true relations of the animal could not possibly be determined. The head and first segment of the body were confounded together into a triangular mass, destitute of any trace of articulation, and the tail was represented as elongate-conic in form, and composed of twelve very short joints, all being very setose. The figure given by Prof. Milne Edwards, quoted above, was made by him from the original specimen of Montagu, preserved in the British Museum, and represents the animal more faithfully; the lower antennæ are, however, drawn too small and short, a sketch made by us from the same individual many years ago, representing the antennæ as nearly equal in length—possibly from the flagellum of the upper pair being broken off; neither does Prof. Milne Edwards's figure give a correct idea of the dilated structure of the second pair of hands.

The segments of the body are transverse, serrated along the hinder margins, the sides being rounded; the five basal segments of the tail are very short, the sixth being as long as all the rest together, and terminated in an obtuse point, at the sides of which are affixed the terminal pair of tail-legs, which are transformed into a very long setaceous filament, having a shorter one at its base. The segments of the tail are very pilose at the sides. The upper antennæ have a strong basal joint, crenulated along its inner edge, in the middle of which is a small, setose swelling; the following joint is strong, but very much shorter than the preceding, followed by a smaller joint, and the terminal filament, or flagellum, is very slender and multiarticulate, the secondary filament at its base being half the length of the primary one, and

also composed of a considerable number of articuli. The lower antennæ are much shorter than the upper, the basal joints being the thickest, the third furnished with a small oval squamose plate at its extremity, the terminal joints or flagellum slender, extending beyond the base of the flagellum of the upper. The upper surface of the head is uneven (the fissures probably marking the point of fusion of the head with the first joint of the body), terminating in front in a porrected point. The eyes are affixed upon a pair of short, somewhat kidney-shaped lobes. The outer foot-jaws are short, and ciliated on the inner margin. The mandibles are elongated, gradually narrowing to the tip, which is denticulated; they bear a slender, three-jointed appendage, the first joint of which is very short, the second and third longer and nearly equal in length, the latter furnished with long bristles at the tip, set on at right-angles to the joint. The first pair of legs are robust, the wrist is swollen, and armed on its under side with two tubercles a short distance apart; the hand is large and oval, its inferior angle produced into a finger, having a tubercle on its inner edge near the middle, against which the true finger impinges, the latter having a small tubercle on its inner edge, close to its base. The second pair of legs have the hand developed into a large, transversely flattened ovate joint, having several strong spines on its margins, so as to give it a digitated appearance, the terminal finger resembling one of these spines. The third and fourth pairs of legs are slender, having a forward direction, the penultimate joint is very slender, except at the tip, which is dilated and fringed with spinous hairs, the slender terminal finger inserted on its posterior surface within the tip.

The fifth pair of legs are also slender, but with a back-

ward direction (as have also the sixth and seventh pairs); in all these legs the hand is armed near the base of the under margin with a strong spine, against which the extremity of the finger, when closed, impinges, this joint being dilated in the two posterior pairs, and strongly ciliated along both its inner and outer margins and apex, the finger being planted anteriorly within the palm of the concave hand.

The ventral appendages of the five segments of the tail are free, consisting, in each segment, of two pairs of delicate, elongate-ovate plates, each pair attached to a basal, three-jointed footstalk, the first joint of which consists of a plate, having the posterior margin serrated and furnished with several long bristles, the anterior margin being fringed with plumose hairs, as also the inner margin of the third joint, as well as both those of the subtending plates.

The sixth segment is semi-ovate, and furnished at each side with an appendage formed of a single-jointed peduncle, supporting one long and one short filamentary branches formed of numerous articuli, increasing in length as they diminish in size towards the distal extremities.

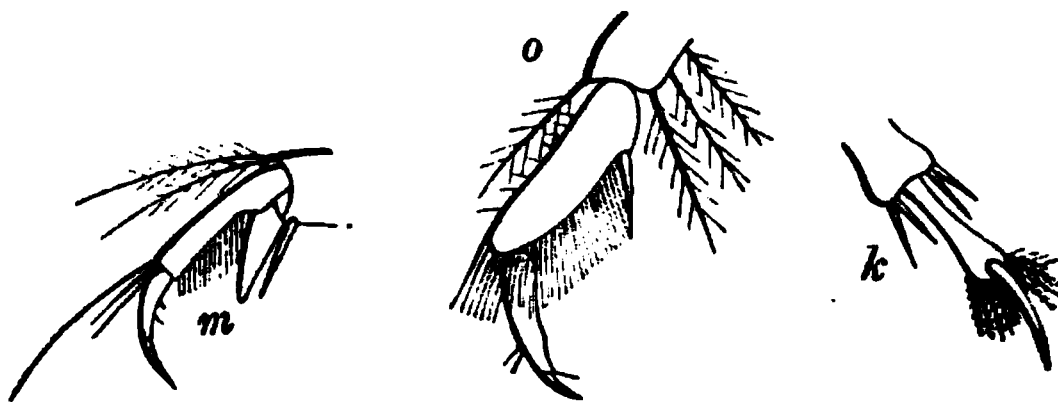
We only know the female of this species.

The incubatory pouch is formed of very slender, semi-transparent plates, which permit the large eggs enclosed to be distinctly visible.

The general colour of the animal, when alive, is yellowish-white, the hairs and divisions between the segments of the body partaking more of the former colour.

Colonel Montagu took this species on the large scallop (*Pecten maximus*) at Salcombe, on the South Devonshire coast. It has also been taken off Guernsey, by the Rev.

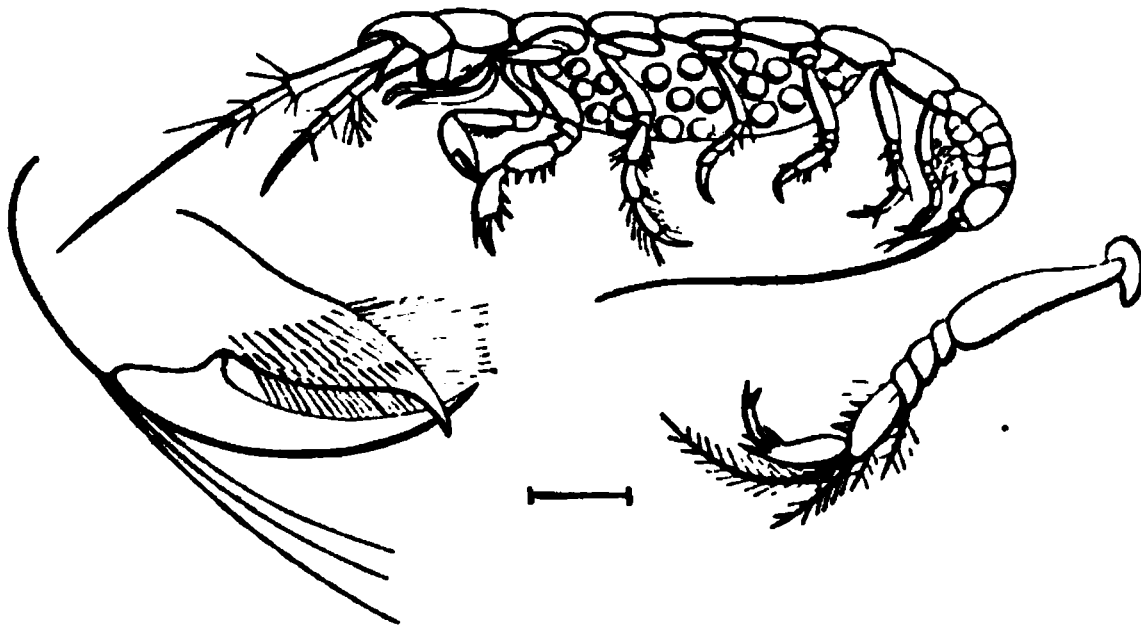
A. M. Norman, and we have taken it, in company with the late Mr. Barlee, in Plymouth Sound. Mr. W. P. Cocks found it, rarely, amongst *Sertulariæ* and other trawl refuse, in the middle of the month of April.



APSEUDES TALPA. (EXTREMITY OF FEET.)

ISOPODA.
ABERRANTIA.

TANAIDÆ.



APSEUDES LATREILLII.

Specific character. Body smooth, destitute of hairs on the sides. Head terminating in front in a deflexed point. Terminal segment of the tail not more than half the length of the preceding portion of the pleon. First pair of gnathopoda moderately large, the hand produced at its lower angle into a strong finger, which is densely hairy, but destitute of tubercles or spines, as is also the true movable finger.

Length one-fourth of an inch.

Rhæa Latreillii (!) MILNE EDWARDS, Ann. Sci. Nat. V. xiii. p. 288, pl. 18A.

THE specimen from which the accompanying figure is drawn bears so great a resemblance to Milne Edwards's figure of *Rhæa Latreillii* that we have no doubt as to the identity of the two animals. The deflexed rostrum, or advanced point of the head, the comparatively large size of the second pair of feet, the more slender hand with the smooth fingers in the first pair of limbs, are all characters observable in both.

The small central point of the head, or rostrum, is slightly down-curved. The orbital process is produced to a pointed apex. The superior antennæ have the peduncle smooth, and the secondary appendage of the flagellum scarcely half as long as the primary. The inferior antenna reaches but little beyond the peduncle

of the superior. The first pair of hands have the carpus rather longer than the propodos, and ciliated along the inferior margin; the propodos has the inferior digital process liberally ciliated over the surface, and more so along the margins; the dactylos is curved, smooth, and inversely corresponding in form to the margin of the opposing finger. The second pair of hands have the margins of the carpus and propodos fringed with strong spines, and the finger planted in the middle of the extremity of the flattened propodos. The succeeding legs appear not to differ much from those of the preceding species, except the posterior pair, which, instead of having the propodos fringed with cilia, have it armed with short, stiff spines, that increase in length towards the distal extremity. In most other points this species appears to differ but little from the preceding.

We have seen but a solitary specimen, which was sent to us by our esteemed correspondent the Rev. A. M. Norman, who obtained it on the coast of Northumberland.

This specimen was a female, and carried a mass of large, circular, orange-coloured eggs between the second and penultimate segments of the pereion, beneath a transparent membranous sac.

M. Milne Edwards first described this species in the *Ann. des Sci. Nat.* t. xiii. p. 288, pl. 13A, fig. 1-8, from a specimen dredged on an oyster-bank of Port Louis; but in his description in *Hist. des Crust.* t. iii. p. 141, he gives the coast of Brittany as the habitat.

The extreme paucity in the number of the specimens both of this and the preceding species, that have been recorded, induces us to believe that the true habitat and habits of the genus have yet to be discovered.

ISOPODA.

ABERRANTIA.

ANTHURIDÆ.

Fam.—ANTHURIDÆ. (*Anthuradæ*—Leach.)

THE animals in this family are very long and slender, the head distinct from the pereion, the antennæ very short and nearly equal in length, the first pair of legs large and subchelate, the remaining six pairs nearly equal in size and uniform in shape, the pleon furnished with biramose squamose appendages, terminal pair of pleopoda transformed into a pair of scale-like appendages at each side of the terminal joint.

The head is nearly oval, with the eyes small, oval, formed of but very few lenses, and placed near the anterior angles of the head, behind the antennæ, which are very short and gradually attenuated to the tip. In the figures in page 160, they are represented as they appeared to us under a lens, in the very ill-preserved type of the genus, originally described by Montagu, now in the British Museum. In specimens preserved in spirit of a second species, contained in the Hopeian Collection, the upper pair are placed a little apart at the base, whilst the lower pair, which are the most robust, arises close together, their basal joint being projected and brought into contact with each other along their inner edge, thus forming a protection from above to the oral organs. The upper pair of antennæ are composed of a three-jointed peduncle and a four-jointed flagellum, the terminal joint furnished with a long pencil of hairs at the tip. The lower, and more robust pair, consist of five joints, of which the second and third are shorter than the first and fourth; the terminal joint is conical, and furnished at its tip with a pencil of hairs.

The mouth, of which the peculiar structure has been overlooked by all previous writers, is evidently formed for suction, and consists of a narrow process extending along the anterior half of the under side of the head, and porrected in a point in front.*

The mouth is closed beneath by a pair of foot-jaws, each composed of two oblong, flattened joints, the second of which is slightly curved and somewhat pointed to the tip, and armed along its inner edge with a series of long hairs. Within this pair of foot-jaws appear two long and extremely slender, nearly straight, setæ, of which the extremity, along the inner edge, is finely retro-serrated. We regard this pair of organs as the second pair of maxillæ, very similar in general structure to those of the genus *Æga* and its allies. We have found no trace of the first pair of maxillæ, but the mandibles appear to be represented by a pair of elongated, pointed organs, having a three-jointed palpus, bearing a close general resemblance to the mandibles and their appendages in *Limnoria*, *Æga*, &c. These organs rest within or beneath an elongated, conical, horny piece, of which the tip appears to be deeply bi-sinuated, forming the upper lip, and within the mouth we find another elongated, single organ, thickened at the base, which may possibly represent the 'lèvre inférieure' of Savigny.

The seven following segments of the body are quite distinct, the anterior ones being the longest, whilst the last, or seventh, is the shortest of them all. The incubatory pouch in the females extends from the second to the seventh segment.

The tail is composed of six segments, the four an-

* This description is made from individuals of the second species, above alluded to, to which the name of *Par. Costana* has been applied by Prof. Westwood.

terior of which are soldered together; the fifth is a small segment with the hind margin raised and notched in the middle, and which supports the latero-caudal plates; and the sixth forms the large terminal central plate of the tail.

The family comprises three genera, of which the two following are British.

Genus—ANTHURA. (*Leach.*)

The body is very slender, elongated, and somewhat triquetrous, having the head and segments of the body quite distinct from each other; but the four anterior

Z

SHAPE OF BODY.

segments of the tail are confluent, and so closely attached together, that, in fresh specimens, or in those preserved in spirits, the articulations are not recognizable; the penultimate segment of the tail is short, having on each side a pair of scale-like appendages, representing the terminal pair of tail-legs.

The pleopoda consist of, at least, four pairs of oval plates, strongly ciliated, on each side of the ventral surface of the basal segments of the tail. They are of nearly equal size, and arranged so as to lie longi-

tudinally, but, in the first pair alone, the outer division is very much narrower than the inner division. The terminal pair of tail-feet are transformed into a pair of crustaceous plates, affixed to each side of the penultimate segment at its base; the inner plates have a transverse articulation beyond the middle,* and the outer plate is affixed vertically and falls back, when at rest, upon the dorsum of the terminal joint, fitting into the depression formed by the transverse carina on that segment. The lower figure, *P z*, in page 160, represents the lateral view of the tail of *A. gracilis*, being the four basal segments (represented as entirely soldered into one joint), beneath which is seen three pairs of tail-feet in a mass, the long appendage arising from the lower anterior angle of the segment representing the anterior large pair that covers the rest as an operculum; the fifth segment of the tail is also shown as distinct, followed by the large laterally-deflexed portion of the terminal pair of tail-feet or scales which it supports; the articulated extremity of the two inner divisions of this pair of appendages, and the truncate extremity of the middle portion of the tail being also shown in the deflexed portion of the figure.

The left-hand figure, *P''*, represents the ventral surface of the two terminal segments of the body, and of the tail, showing the inner division of the anterior pair of tail-feet, concealing the outer division of the same pair as well as the whole of the remaining pairs of the organs. Fig. *p* represents the outer division of the left-hand pair of the first respiratory tail-feet, and fig. *p''*, a portion of its lateral, deeply ciliated margins, showing the insertion of the ciliæ.

The anterior pair of feet are strong but short, not

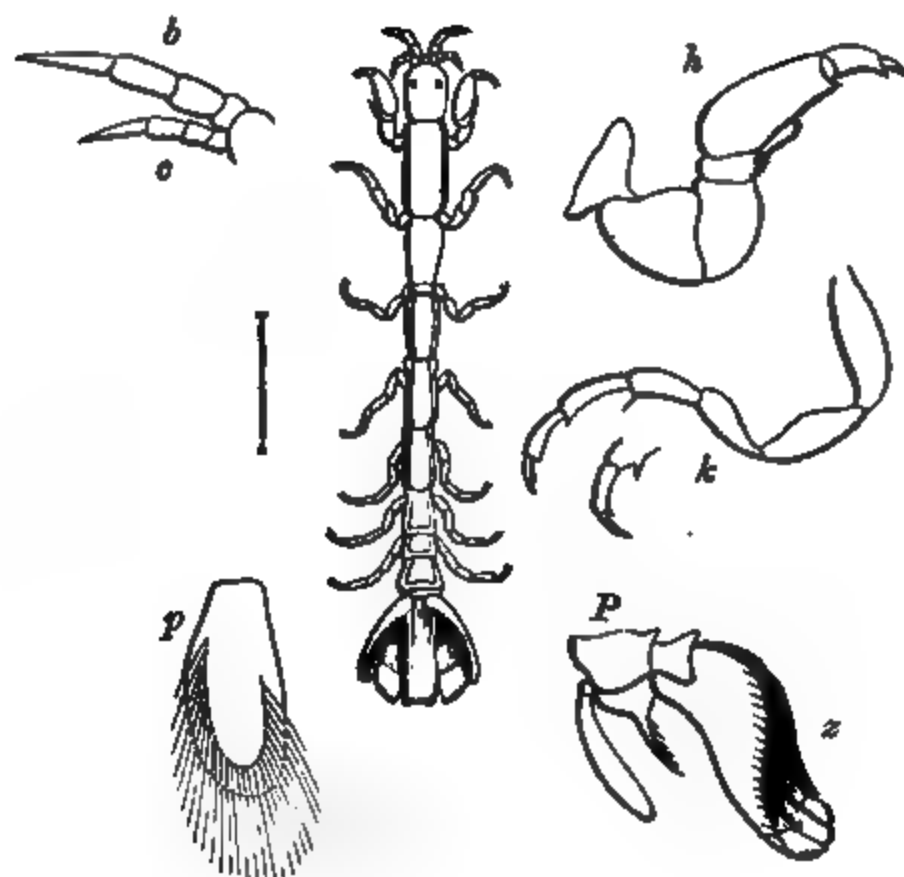
* In *Æga* this articulation is oblique, and extends to the insertion of the outer plate.

extending beyond the front of the head; the hand is ovate, protected at the base of its inner margin by the produced extremity of the preceding joint; the finger is strong, and terminated by a distinct unguis. The six other pairs of legs are much more slender and simple, terminated by a short, rather strong, curved finger, and a distinct terminal unguis.

The very elongate and slender form of the animals of this genus gives them a certain amount of resemblance to the species of *Arcturus*, and has led to their being placed in the family of which *Idotea* is the type; but Dr. Leach long ago had the tact to perceive their claims to form a distinct family, and, although their general form, short antennæ, and strong fore legs, give them a certain similarity to *Tanais*, yet we apprehend (now that their real structure has, for the first time, been described from a minute analytical examination of their oral organs) that their true affinities will be admitted to be in the immediate neighbourhood of the *Ægida*, one species of which at least, *Conilera cylindracea*, approaches them in its elongated cylindrical form; indeed, Dr. Leach suggested that this animal might possibly be referable to the family *Anthuridæ*, and, accordingly, in Mr. White's catalogue of British Crustacea, it is placed as a second species under the name of *Anthura cylindrica*, appearing again in a subsequent page, in its proper place and name, as *Conilera cylindracea*.

ISOPODA.
ABERRANTIA.

ANTHURIDÆ.



ANTHURA GRACILIS.

Specific character. Long, slender, sub-compressed, sub-cylindrical. Segments of the body with a strong, lateral ridge; terminal segments sub-triangular. Four anterior segments of the pleon soldered closely together, forming a subtriangular mass; middle tail-piece keeled down the centre, with three very delicate, longitudinal, raised lines, down the sides of the keel; apex truncate; apex of the inner division of the lateral scales obliquely truncated, and crenulated.

Length 5 lines.

Oniscus gracilis. MONTAGU, Trans. Linn. Soc. ix. p. 108, t. 5, fig. 6.

Anthura gracilis. LAMACH, Edinb. Encyc. vii. p. 604. Trans. Linn. Soc. xi. p. 866. Suppl. Enc. Brit. DESMAREST, Cons. Crust. p. 291, t. 46, fig. 13. SAMOUVILLE, Entom. Compend. p. 107. GUÉLIN MÉRIVILLE, Icon. R. An. t. 30, fig. 6. MILNE EDWARDS, Crust. iii. p. 136, t. 31, fig. 3. WHITE, B. M. Cat. Brit. Crust. p. 67. Pop. Hist. Brit. Crust. p. 225, pl. 12, fig. 4.* GOSSE, Man. Mar. Zool. i. fig. 248.

* In this figure two segments of the body and one of the pairs of legs are omitted.

THIS species is well defined by the strong, raised, lateral margins to the segments of the body and tail, by the consolidation of the basal segments of the latter almost into a solid mass, the articulations being, however, clearly indicated by impressions on the under edge of the lateral margin, and especially by the characters of the terminal segment of the tail and its appendages, noticed in the specific characters given above. It is, however, rather difficult to describe precisely the curious construction of this terminal portion of the body. Montagu says that "the body is terminated by five large caudal appendages truncated at their ends, these are deflected nearly at right-angles with the body, the middle one fixed, and the lateral ones jointed and spread a little upwards in a *semicircular* form." The last term is not, however, at all expressive, and should, doubtless, have been "semicylindrical," since the apparatus, when open, forms a *concave* cup-like disc, and when at rest, from being affixed vertically, the outer plate falls back and shuts down upon the dorsum of the middle tail-plate, like the two wings of a closed triptych. The irregularly crenulated margin of the extremity of these caudal plates also affords another distinctive character. Not having seen fresh specimens of this species, we are unable to give a more precise description of the antennæ than is conveyed in our generic observations.

The fore legs, although not longer than the succeeding pairs, are very much more robust, with a large, elongate-ovate hand, the upper basal angle being swollen, and the palm having a deep incision along its outer half (which we believe to be caused by the elongation of the outer and lower angle of the preceding joint) which is slightly rugose. The other legs are much more slender, with the joints of nearly equal length, the fifth and sixth having

a small spine at the extremity of the under margin; the terminal dactylos also ends in a small, sharp-pointed unguis.

The colour of the animal is pale yellow, clouded with rufous.

The species was first taken on the Coast of Devonshire, by the late Colonel Montagu, and since by Mr. Barlee, at Falmouth, and off the Thatcher Rock, Torbay, by Mr. Walker, of Exeter.

The following vignette represents some fishermen drawing in a seyne full of fish, on most of which these crustacea attach themselves.

SEYNE.

Genus—PARANTHURA.

Oliaka (?). Risso. Horn.

Generic character. Like *Anthura*, except in the structure of the pleon, which has the several segments distinctly articulated with each other, and carries the normal number of pleopoda.

THE animal is long, slender, and linear; the head distinct from the first segment of the body, the latter consisting of seven segments, the whole being nearly subequal, except the last, which is shorter than the preceding. The tail is short, being about one-eighth of the length of the entire animal, consisting of seven separate segments, six of which support appendages. The eyes are sessile and ovate. The superior pair of antennæ are short, being about the length of the head, each being formed of six joints, gradually diminishing in size to the last. The inferior pair is longer and much stronger than the superior, and five-jointed, the large basal joint being attached to the head by a short, indistinct joint; the second, third, and fourth joints gradually increase in length, the fourth being not quite so long as the basal joint; the fifth joint is nearly as long as the fourth, and gradually attenuated to the tip, furnished with long setæ, and terminated by a very minute, exarticulate point. The three anterior pairs of legs (namely, the two pairs of gnathopoda and first pair of pereopoda) are formed upon the same type, and terminate in a subchelate hand. The four posterior pairs of legs are more slender, and attached in an opposite direction to the anterior pair. Each of the tail appendages (or pleopoda) consists of two membranaceous plates for respiration;

the first pair are large, and have the external branch narrow, and attached so as to lie upon the outer margin of the other, which is ovate and foliaceous; the four pairs next succeeding are ovate, membranous, and foliaceous. The posterior pair are articulated to the sixth segment dorsally. The upper and outer branch is foliaceous, and affixed vertically; the inner and inferior branch is two-jointed, and placed horizontally below the plane of the middle tail-piece, which is ovate, and terminates in an obtusely pointed apex.

There is a species of this genus, an inch in length, in the Museum of the Jardin des Plantes, from Port Western, New Holland.

ISOPODA.
ABERRANTIA.

ANTHURIDÆ.

PARANTHURA COSTANA.

Specific character. Cylindrical; segments of the body of nearly equal size; middle tail-piece not carinated, ovate at the extremity; inner branch of the sixth pair of tail appendages articulated and rounded at its extremity. Hand of the first pair of legs produced into a minute, reflexed tubercle at its extreme inner base.

Anthura gracilis. MILNE EDWARDS, Hist. des Crust. iii. p. 186, pl. 31, fig. 3, but not of Montagu, ut supra.

Idotea penicillata. RISSO, Hist. N. Crust. Nice, 1816, p. 137, pl. 3, fig. 10 (?). DESMAREST, Crust. p. 315.

Olika penicillata. RISSO, Hist. N. Eur. Merid. 5, p. 113. HOPE, Cat. Ital. Crust. p. 27 (?).

IN the Hopeian Collection of Crustacea are preserved several specimens of this species, fixed on card, to which is attached a label "S. W. Coast of England on Broad Sea Weed." It differs from *A. gracilis* in its more cylindrical form, the sides of the body wanting the raised lateral margins, the distinct articulation of the

five basal segments of the tail, the smooth surface of the middle tail-piece, oval at its extremity, the very distinct and oval terminal division of the inner plate of the side appendage of the tail, and the smaller and narrower size of the outer division. The hand of the fore pair of legs also wants the notch along its under edge. It is of a pale bone colour, covered with minute black dots. The mouth is enclosed between horny plates (†) and furnished with a pair of straight, elongate-conic mandibles, pointed at the tip, having a large, three-jointed, palpiform appendage fixed at its base on the inner edge. The maxillæ consist of a pair of long, very slender, slightly curved, lancet-like pieces, retro-serrated at the apex, and the mouth is closed beneath by a broad pair of foot-jaws, which are terminated by two large, flat joints, the apical one being strongly ciliated.

In all these particulars it perfectly agrees with other specimens preserved in spirits in the same collection, with a label inscribed "*Anthura gracilis*," in the handwriting of Signor Costa, of Naples, with whom Mr. Hope was long in friendly communication upon the marine animals of the Mediterranean. On referring to Mr. Hope's catalogue of the Mediterranean Crustacea, we find only one species of *Anthura* indicated with the name of *A. gracilis*, which, from a copy marked by S. Costa, we find to be in his collection; and we have, therefore, no doubt that the species was communicated by him to Mr. Hope. We therefore at first hesitated to consider the species as a real native of this country (fearing some confusion might have occurred as to the labels of the South Western Coast specimens), and, in honour to Signor Costa, we proposed for the species the name of *Paranthura Costana*. Whilst, however, this

sheet was in the printer's hands, we had the pleasure to receive from the Rev. A. M. Norman, specimens taken by himself off the Channel Islands ; so that the claim of the species to be regarded as British is fully confirmed. The [figure given] by Mr. Milne Edwards in the work above referred to as *A. gracilis*, is no doubt intended for this species, since it was taken on the neighbouring coast of La Manche. But, since he mistook it for *Anthura gracilis*, the retention of his specific name, founded, as it was, in error, would lead to confusion ; we have therefore thought it desirable to adopt another not open to the same objection.

BRIGHTON FISHERMEN.

ISOPODA.

ABERRANTIA.

ANCEIDÆ.

ANCEIDÆ.

| | |
|--|----------------|
| <i>Praniziens.</i> | MILNE EDWARDS. |
| <i>Pranizidæ.</i> | DANA. |
| <i>Pranizadæ.</i> | VAN BENEDEN. |
| <i>Decempedes.</i> | LATREILLE. |
| (Males) <i>Gnathides, Gnathonii, Gnathionii.</i> | LEACH. |
| <i>Ancéens.</i> | MILNE EDWARDS. |
| (Females) <i>Praniziens prop. dites.</i> | MILNE EDWARDS |
| <i>Pranizidæ.</i> | WHITE. DANA. |

THE head has the first (or more-probably the first and second) segments of the body fused with it; it is very large, and flattened, or dorsally concave in the males; quadrate or ovate, and of moderate size, in the females. The antennæ are small or of moderate length, nearly equal, inserted widely apart, composed of a three-jointed peduncle and an articulated flagellum. The mouth is very anomalous in its structure, differing very greatly in the adult from the young, as well as in the opposite sexes of the same species. In the adult males the front of the head is armed with a very large pair of porrected mandibles; in the early stages the mouth in both sexes is suctorial in its character. The body is composed of only five segments, of which the three posterior are soldered together in the females, so as to form a large, oval mass. There are only five pairs of slender, simple legs. The pleon is of small size and narrow, but well developed, consisting of six segments, of which the last is small and triangular: each segment being provided on its ventral surface with a pair of delicate, membranous, biramous, squamiform appendages, which are entirely free, and not covered by a larger anterior pair or operculum. The terminal pair on each side form, with the

middle tail-piece (telson), a five-lobed organ useful in swimming to guide the animal.

The animals composing this most anomalous family have, until quite recently, been considered as forming, not only two distinct genera, but even have been arranged by M. Edwards and Dana as distinct tribes. The observations of M. Hesse, of Brest, however, leave no room to doubt that the two supposed genera, *Anceus* and *Praniza*, are but the males and females of one genus, although his assertion that they are but different phases of one and the same animal cannot be accepted. It seems, however, sufficiently proved, that one of these animals of small size, which would heretofore have been unhesitatingly called a *Praniza*, if kept in confinement, becomes developed into a female (*Praniza*), while a second, only slightly differing, becomes a fully developed male (*Anceus*). We therefore adopt the suggestion of M. Hesse (not indeed for the reason which he assigns, that a *Praniza* is transformed into an *Anceus*—a statement which our observations will sufficiently disprove), but in conformity with the usual rule of priority, as well as that of accepting the denomination of the male rather than that of the female animal, and, accordingly, retain for the group the family name of *Anceidæ*. Strictly speaking, however, the name *Gnathiidæ* should be given to the family, Leach's name *Gnathia* having the priority in point of date over that of *Anceus*; but as Leach himself omitted the genus in his later works, and there is a well acknowledged genus, *Gnathium*, amongst the heteromorous beetles proposed by Kirby, we have preferred using the generally adopted name of *Anceus*.

ISOPODA.

ANCEIDÆ.

ABERRANTIA.

Genus—ANCEUS.

Gnathia. LEACH, Edinb. Encyc. (male).*Anceus*. RISSO, Crust. des Nice, p. 51, 1816 (male). DESM.*Praniza*. LEACH, MSS. RISSO, LATR., LAM., DESM. (female).

Generic character. *Male*. Cephalon large, broad, quadrate. Pereion having the first two segments absent, or fused with the cephalon; the two next separated from the three posterior. Pleon with six segments, the posterior terminating acutely. Eyes large and placed at the antero-lateral angle of the head. Antennæ simple, subequal. Mandibles anteriorly produced from the anterior margin of the cephalon. First gnathopoda wanting. Second pair of gnathopoda transformed into the outer appendage of the mouth. Pereiopoda subequal, the three posterior pairs reversed. Pleopoda biramose, posterior pair planted on each side of the caudal segment. These are the characters of the animals long known only as *Anceus*.

Female. Cephalon small, quadrate. Pereion having the first two segments wanting or fused with the cephalon, the two succeeding distinct, small, subequal; the three last fused together. Pleon as in the male. This character distinguishes the animals long known as *Praniza*.

THE history of this genus is so remarkable as to merit a detailed account. The earliest record of one of these animals is contained in the microscopical work of Slabber, "Natuurkundige Verlustigingen," republished at Nuremberg in 1775, under the title of "Physicalischen Belustigungen," 4to, p. 37, pl. 9, where the author gives the representation, and "Wahrnehmung eines Oniscus marinus," being a satisfactory figure of a *Praniza*, which he had found on the shores of Holland, during four months of the year, in considerable quantities, and which exhibited great agility in the water. This figure was copied by Latreille in the great "Encyclopédie Métho-

dique, Crustaces," pl. 329, fig. 24, and described in the text as "Crustace du genre *Praniza* du Docteur Leach."

In the seventh volume of the "Transactions of the Linnean Society," Col. Montagu published the description and figure of an animal under the name of *Cancer maxillaris*, which proves to be the male of this genus; and in the ninth volume of the same work, he also published a figure and description of a female, under the name of *Oniscus cæruleatus*.*

In "The Edinburgh Encyclopædia," vol. 7, Dr. Leach, in adopting the Latreillian principles of classification to the Crustacea, proposed the generic name of *Gnathia* for the *Cancer maxillaris*. He had previously, as above stated, proposed the MS. name of *Praniza* for the female.

In "Hist. Nat. des Crust. de Nice," 1816, p. 52, pl. 2, fig. 10, Risso subsequently described the male of a Mediterranean species under the name of *Anceus forficularis*.

In the fifth volume of "Loudon's Magazine of Natural History," the late Dr. Johnston published some observations on the genus *Praniza*, and added the description and figure of a second species, *Praniza fuscata*, observing that these animals, by means of their legs, are able to creep on the bottom of the sea, which they do slowly, but they swim with greater rapidity, propelling themselves forward by the quick motions of the series of ciliated fins placed beneath the tail.

The remarkable structure of what is supposed to be the respiratory apparatus of these animals (intermediate as it is between that of the typical Amphipoda—namely, a series of free appendages—and that of the typical Isopoda—in which the appendages are enclosed by a bivalve operculum), induced Professor Westwood to com-

* This figure was also copied in the Encyclopédie Méthodique, pl. 336, fig. 28, but under the erroneous name of *Oniscus (Calino) thoracicus* of Montagu.

municate a memoir on the subject to the meeting of the British Association at Oxford, in 1832;—a translation of which, with additions, containing the description of some supposed new species of *Praniza*, was published in the “*Annales des Sciences Naturelles*.” Other supposed species of the two sexes of this genus were published by other authors, namely, *Praniza branchialis*, of Otto (in “*Nova Acta*” of Bonn, vol. xiv.); *Praniza ventricosa*, *plumosa*, and *mesosoma*, of Risso (“*Hist. Nat. Eur. Merid.*” vol. v.); *Praniza Reinhardi*, of Kröyer (“*Grönlands Amphipoder*”); *Anceus rapax*, of Milne Edwards (“*Hist. Nat. Crust.*” vol. iii.); *Anceus vorax*, of Lucas (“*Annales Soc. Ent. France*,” 1849); *Praniza mauritanica*, of Lucas (“*Op. Cit.*”); and *Praniza obesa*, of Lucas (“*Op. Cit.*” and “*Hist. Nat. Alger*,” tome i.).

Whilst establishing the genera *Gnathia* and *Praniza* for the two sexes of this genus, Dr. Leach had the tact to perceive the possibility of their being sexes of one and the same species, observing (“*Edin. Encyc.*” vii. p. 402) that “Mr. Leach supposes that *Oniscus cæruleatus*, of Montagu, is the female of this animal” (*Gnathia termioides*, or *maxillaris*, Mont.). Hence possibly the reason why Dr. Leach did not introduce his MS. genus *Praniza* into any of his works; indeed, he omitted *Gnathia* in his celebrated memoir published in the “*Transactions of the Linnean Society*,” vol. xi. 1815.

In November, 1855, M. Hesse communicated a memoir to the Académie des Sciences, of Paris,* in which he announced the startling fact that *Praniza* was but the larva state of *Anceus*, and that, by a true metamorphosis, *Praniza* was transformed into *Anceus*.

In the beginning of the following year, 1856, our

* *Comptes rendus*, Nov. 1855, March 1858. *Ann. des Sci. Nat.* 1858, t. ix. p. 89.

friend, A. H. Haliday, Esq., communicated to us specimens both of *Anceus* and *Praniza*, which he had first taken in 1847, on the shores of Strangford Lough, in the North of Ireland, in some numbers, and in equal proportions, in the summer, although in the month of February the *Pranizæ* were much less abundant than the *Ancei*. Mr. Haliday's specimens were taken in small cavities in the surface of the clay, under stones, sometimes singly, oftener two, and even three and four in each hole; the smaller green ones were few in comparison. The new-born young of the *Praniza* have all the characteristic form of the parent, but the posterior thoracic segments not so completely confounded together.*

Referring to M. Hesse's memoir, Mr. Haliday observed in his communication to us, that "notwithstanding their constant association, and the fact that the *Anceus* is always of pretty uniform size, and *Praniza* varies from about the same down to the smallest size, I should never have guessed that the latter was the larva of the former; and yet I do not understand how to combine it with my *positive observation* of *Praniza* producing young—the very eyes of which (before birth) were visible through the transparent integuments of the parent." We are able fully to confirm this statement, as some of Mr. Haliday's specimens of the *Pranizæ* still exhibit the mass of eggs within the incubatory pouch, and from others the minute young have escaped in the spirit in which they are preserved.

Mr. A. White, in his "Popular History of British Crustacea," 1857, still further confused the matter by observing that "there is some likelihood that *Anceus* may prove to be one of the stages of *Praniza*."

* Annals Nat. Hist. 1848, vol. i. p. 65.

In 1858, Mr. Spence Bate communicated a memoir "on *Praniza* and *Anceus*, and their Affinity to each other," in the "Annals of Natural History," 3 ser. vol. ii. pl. 6 and 7, in which, after a careful description of the structure of the two, *Anceus* and *Praniza*, and a review of the statements of previous writers, and especially of the memoir of M. Hesse, he arrived at these conclusions:—

1. That (upon M. Hesse's observation of *Anceus* producing young) *Anceus* is an adult animal.

2. That (upon his own observation of *Praniza* producing young) *Praniza* is an adult animal.

3. That *Praniza*, consequently, cannot be developed into *Anceus*.

4. That *Anceus* is a distinct genus from *Praniza*.

5. That the males of both genera have yet to be discovered.

In 1861, M. Van Beneden, in his "Recherches sur la Faune littorale de Belgique, Crustacés," published a detailed description, with figures, of the *Oniscus* (*Praniza*) *marinus*, of Slabber, as the "état larvaire," and of the *Anceus* as the "état adulte" of the same animal, preceded by a history of the genus, and of the observations of Messieurs Hesse and Spence Bate, together with a supplemental note from the former to the objections of the latter:—

"Si vous prenez des *Pranizes* d'une certaine dimension, c'est-à-dire, près de l'époque de leur transformation, vous n'avez plus, au bout de quelques jours, des *Pranizes* mais des *Ancées* des deux sexes—quelques jours avant la transformation des *Pranizes* femelles en *Ancées* les œufs qui préexistent s'aperçoivent à travers la peau, et si M. Bate avait vu la suite de cette operation, il eut constaté que sa *Pranize* était devenue *Ancée*."

In 1864, M. Hesse published his detailed "Mémoire sur les *Pranizes* et les *Ancées*," 4to, Paris, with a vast amount of supplemental materials, from which he deduced the following results:—

1. That *Praniza* is only a "phase de la métamorphose de la larve en *Ancée*."

2. That at the end of the larval state, in which sexual differences are not perceivable, these crustacea are transformed into males and females.

3. That the male and female are completely distinct in form, and that the young state, or *Praniza* form, is so unlike that of the two sexes, that it may be mistaken for a different species.

4. That the female of *Anceus* had hitherto been totally unknown.

5. That during their larva, or *Praniza* form, they are parasitic on fishes, with a mouth fitted for sucking blood, and that after quitting the fishes and assuming the *Anceus* form, they live "à terre" with a greatly modified form of the mouth, furnished with formidable mandibles.

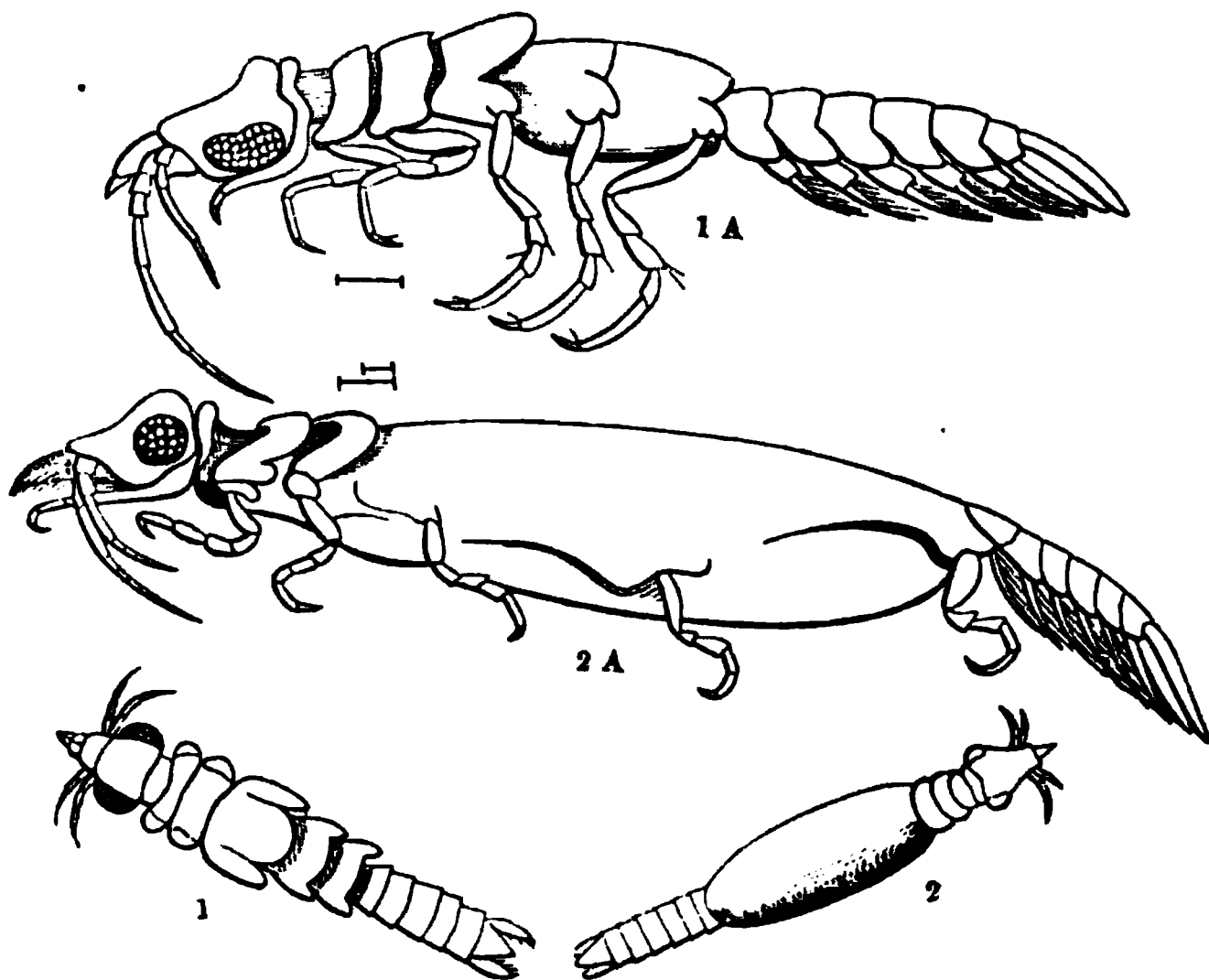
6. That the *Anceus* form is that of their final metamorphosis.

In contrasting these results with the plates which accompany M. Hesse's memoir, we cannot but express our conviction that his conclusions are far from being borne out by his own recorded observations.

If the student will but turn to M. Hesse's elaborate memoir, we think that we shall be able even thence to demonstrate the correctness of our own conclusions on these anomalous animals. In plate 1, the figures 9 and 11 nearly correspond in the natural size of the objects, but materially differ in form; whereas all the larvæ in fig. 30 correspond only with fig. 11. This latter circumstance probably may be only the result of the artist's

speed. Now we contend, and our own observations convince us, that fig. 10 is the larval stage of the male, and that fig. 11 is a similarly advanced condition, or the larval stage of the female. At the period when the larvæ quit the ovigerous pouch of the parent, the similarity of the two sexes, it is true, is very close, and not readily distinguishable; but even at this early period the transparent membranes enveloping the terminal segments of the pereion, seen in the woodcut in page 177, indicates a form more nearly approaching to that of the adult female, (or *Praniza* form of *Anceus*), than to that of the male or true *Anceus*.

We have examined great numbers of the larvæ just as they are ready to quit the ovi-pouch, and think that we could determine a sexual distinction, but we hesitate to pronounce this with certainty, because it appeared to us that both sexes were never developed in the same

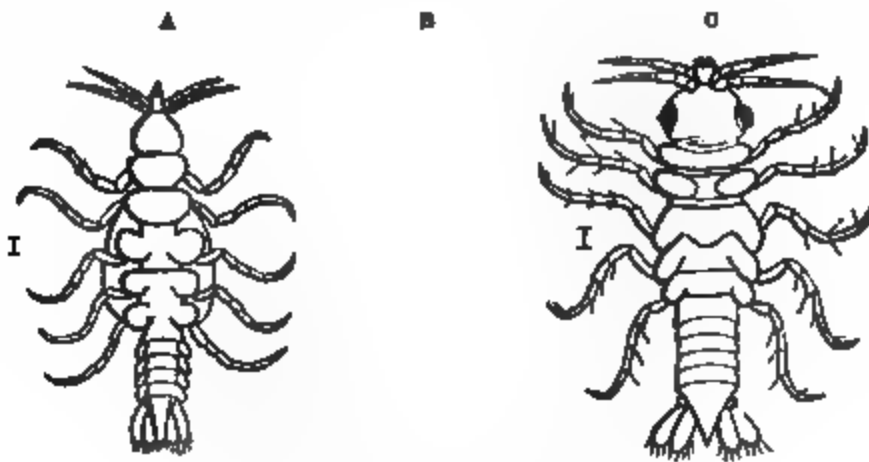


DEVELOPMENT OF ANCEUS.

ovi-pouch: the young of one animal appearing to be all males, those of another being all females, so that the variation may have been the result of an older or younger stage of development.

But, however great the similarity may be between the two sexes at the time of their first leaving the ovi-pouch of the parent, they very soon exhibit a distinguishable variation, as seen in the woodcut on the preceding page, in which fig. 1 (of which 1A is an enlarged figure, seen laterally) represents the male larva. That of the female (figs. 2 and 2A, seen laterally) has the three posterior segments of the pereion losing their crustaceous and segmental character, and putting on that of a membranous condition, and becoming fused together into one long segment.

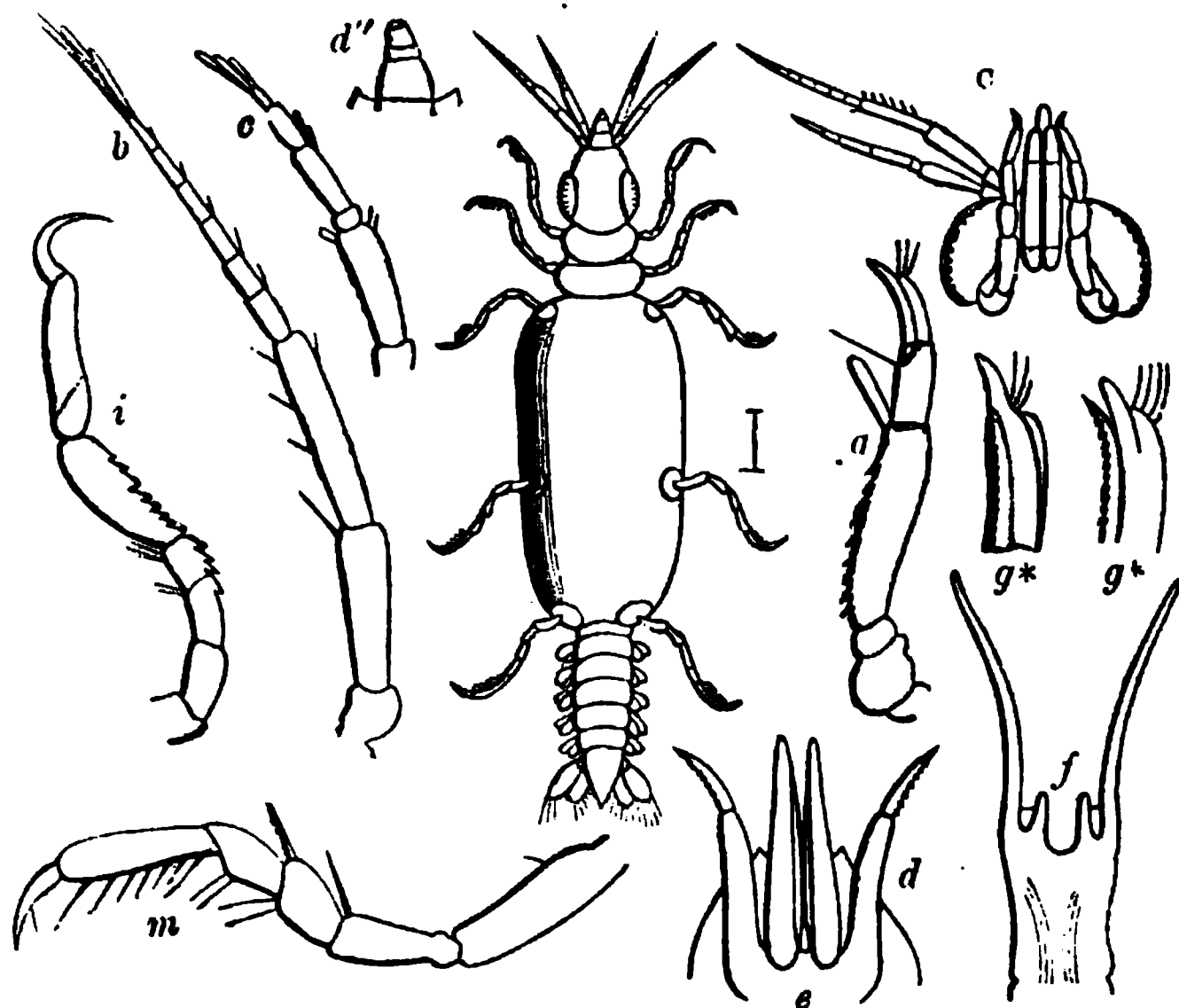
That of the male, as shown in fig. 1, of which 1A is an enlarged representation (seen laterally), has the segments well defined and crustaceous, but the central, that is the third (though homologically the fifth), segment of the pereion, considerably increased in length, with the coxæ partially fused with the segment. Viewed laterally, this segment is dorsally elevated above those



DEVELOPMENT OF ANCEUS.

Fig. A. Young of *Anceus Edwardii* (p. 201). Fig. B. Eggs of *Anceus Maxillaris* (pp. 176 and 192).

posterior to it. That we have not been misled into accepting as parallel stages, conditions which are only successive changes, as is stated by M. Hesse to be the case, we are assured, from the circumstance that we have seen, and have in our possession, specimens of the female from the smallest to the largest size; and similar ones of the male also, beginning, in each case, with



DEVELOPMENT OF ANCEUS.

This cut represents an animal, with its details, which agrees entirely with Montagu's figure of *Praniza cæruleata*, and which, notwithstanding its large size, we presume must now be regarded as the fully developed larval form of the female. (*Praniza fuscata* of Johnston, *Oniscus marinus* of Slabber, *Praniza cæruleata* of Costa, *Praniza maculata* of Westwood, *Praniza mauritanica* of Lucas, and *Praniza Reinhardi* of Kröyer, judging from the figures given by these various authors, are animals in their larval condition, whereas *Praniza obesa* of Lucas decidedly represents an adult ovigerous female.) In the details given above are representations taken in different points of view of the maxillipod (*g*), showing the varied positions of the serrated portion; the mandibles also (*d*) are much weaker than those organs are represented either by Mr. Spence Bate (*Annals N. H.* s. 3, vol. ii. pl. 6), or by M. Hesse.

animals scarcely a twentieth of an inch in length up to nearly their full growth.

In the young or larval stage, the oral organs are similar in both sexes. In fact the cephalon is much alike in both, being subtriangular; the eyes lateral, placed at the posterior angle of the cephalon, being somewhat larger in the male than in the female. The superior antennæ are shorter than the inferior. The mandibles are anteriorly produced, and developed into sharp-pointed instruments, with the inner margins acutely serrated, the serrations being directed posteriorly. The maxillæ are styliform and sharp; the inner margin of the first pair is slightly serrated. The maxillipods are four-jointed, and each joint supports a strong styliform spine, and the whole of the oral appendages combine together with a sharp process at the apex of the anterior lip, to form a strong lanceolate organ, with which the animal probably cuts its way through the skin of those fish on which it preys.

Posterior to these appendages, near the inferior and outer angle, stands, what we consider to be, the homologue of one of the pairs of gnathopoda.

From analogy with *Tanais*, &c., in which the first segment of the body is fused with the head, we should infer that it is the first segment of the body in *Anceus* which is fused with the head, whence the pair of appendages in question would represent the anterior pair of legs (or first pair of gnathopoda), but in *Tanais*, &c., the second segment of the body is distinct, and bears a pair of legs, whilst in *Anceus* there is no trace either of this second segment or second pair of legs, unless we suppose the hind part of the head and the pair of appendages in question to be the representatives of such second segment and second pair of legs (in which case

there would be no trace of the anterior pair of legs). In the young stages, this pair of appendages is long, narrow, articulated, with a strong hook at the tip; but in the adult state they become more or less dilated and shortened in form, varying in the different species.

The character of the mouth does not appear to vary until the animal has arrived at its adult stage.

We have not yet observed, neither has M. Hesse shown, the way in which, and the period when, the male assumes the large, projecting mandibles. We assume it to be at the last stage between the young animal and the adult, and that these organs are produced at a single moult; though this is not in accordance with our experience of the general development of this class of animals; but, certainly, the adult stage is one of a retrograde character, a circumstance that may account for its departure from the usual or normal plan.

M. Hesse, in the 27th figure of his first plate, gives a figure of a young animal in the act of moulting. He describes it as a female, "represented at the moment when it undergoes its transformation, and while it is yet enclosed within the skin of *Praniza* that it is about to quit." This, from our point of view, is merely the development of a younger female into an older one.

We have in our collection a very similar specimen; it is that of a male, but we cannot perceive in the enclosed animal the large mandibles characteristic of the male adult *Anceus*. We also possess small specimens of the males, not more than two-thirds of the length and half the breadth of the full-grown individuals of this sex, and in which not only are the mandibles scarcely more than one-fourth of the size of those of the latter,*

* See woodcut in page 190: *d* representing one of the mandibles of the full-grown male, and *d d* that of the smaller individual.

but the three posterior segments of the body are almost as compactly soldered into a mass as in the females, whilst the two large plates covering the mouth are fully developed. These small males must, we should presume, be subject to another moulting before arriving at the fully developed state of the male sex, unless, indeed, they are slightly developed specimens, such as are known to occur in most cornuted species of animals. The female is said to be parasitic in the young state, and to live in crevices of the rocks when full grown. We believe that this is the case also with the male, and that both males and females change their oral organs with the final or adult moulting.

The following remarks which we make on the habits and structure of these animals are so much at variance with the common notions concerning crustaceous animals, so high in the class as those of this genus, that we think it but just to ourselves to say, that we have only arrived at them after close and numerous dissections, and a long consideration of the subject.

The females live parasitically on fish, burying their heads almost to the eyes; and we repeat that we believe, that up to the same period the male does also; but with the adult moult the female quits the parasitic life for a new kind of existence. With the adult moult the male gets rid of the lanceolate oral appendages, and large, projecting mandibles are developed. We have some reason to believe that the production of the great prehensile mandibles of the male may be produced after the animal has put on the adult form, since we have several specimens in which these appendages are membranous, and have not yet acquired their distinctive form. It may be, however, that our specimens represent those which, by

some accident, have lost the mandibles, which are now undergoing reproduction.

The oral appendages of the female also undergo a great change. As in the male, the lanceolate organs of the mouth are lost; but, unlike the male, they are replaced by no other appendages. Dissection shows us that they have neither mandibles nor the anterior pair of maxillæ. The only appendages which the female adult *Anceus* has upon the oral surface of the cephalon, are the maxillipods and a pair of gnathopoda, and even these are so depreciated in character as to become rudimentary rather than normal appendages. The maxillæ consist of four gradually diminishing joints, supported on a broad base that has the antero-median angle produced to a blunt point. The gnathopods are reduced to two or three joints, at the base of which, on the internal surface, is a broad, exquisitely thin, membranous scale.*

Still more remarkable, beneath these appendages there appears to be neither mouth, stomach, nor alimentary canal.

The immediate assumption of every carcinologist will be that we may have mistaken exuvia, or cast skin, for the animal. With the exuviæ all the appendages, together with the stomach and alimentary canal, are thrown off.

* This delicate membrane is unnoticed by Hesse and other previous writers. It occurs only in the adult females, and is perfectly identical in its character with the membrane forming the outer cover of the ovigerous sac. If we suppose the large outer pair of appendages of the mouth of the female to represent the second pair of legs or gnathopoda, we at once arrive at the conclusion that this membrane is portion of the ovarian sac, which normally exists in this position (see figure of *Paranthura*), and, indeed, in the females of the Irish species it seemed to us, on dissection of several specimens, to be actually continuous with the membrane within the first pair of true legs, and to form, in fact, a jugular opening of the pouch, whence we extracted several of the young, the antennæ of one of which was actually inserted between this pair of supposed gnathopods of the female. See the upper right hand figure in page 190.

But we have not run the risk of such imputation, having carefully examined the structure of the female before the ova were developed, while they were in the ovisac, and after the presence of embryos in the ovi-pouch; we therefore think it possible that exceptions to a common law may exist in this as well as in other things.

The ovi-pouch of this genus appears not formed by a series of fine scales attached to the coxæ, as in the Amphipoda, but by a thin membrane, that is itself the wall of the ventral surface of the animal, which splits into scales when the embryo is ready to take its departure.

M. Hesse states the period of incubation to be from twenty to twenty-five days, and sometimes less, and he believes that impregnation takes place prior to the last or adult moult of the animal. This is contrary to our anticipation, and, indeed, contrary to the common law of nature. We have certainly dissected adult animals that have not had the trace of ova. We therefore believe that immediately after the animal has undergone the adult moulting, it ceases from its gormandizing and commences breeding, and that, consequently, impregnation takes place immediately after the moult.

Observers must have noticed that in the younger stage—that is, until the animal ceased to have a digestive apparatus—the animal, by feeding, distends the posterior portion of the pereion to a considerable extent, whence M. Hesse says that “sometimes they are so gorged with blood that they become as distended as if they were full of eggs.”

It must strike the physiologist as a remarkable circumstance, that the part which becomes distended by feeding is not the stomach, which in crustacea exists in the *cephalon*, but that part which afterwards becomes the reservoir of the future progeny.

In the earlier period of its parasitic life, the female takes a green colour, which at a later stage deepens into a bright blue. We speak of the common species round our coast, to which Montagu gave the specific name of *cæruleata*. M. Hesse has figured one of a brilliant red; we have never seen such, but it is not improbable that some species may change in their colour, which most probably varies with the condition of the food, for we have taken them white, grey, green, blue, and brown.

An examination of the material confined within this portion of the pereion shows it to consist of oil and fat globules, and we have been able to determine that it is intimately associated with the nourishment of the animal, since by keeping them without food the coloured mass decreases in size. It is such an animal that Mr. Spence Bate figured in his paper "on *Praniza* and *Anceus*," "Annals Nat. Hist." for Sept. 1858, where he observes, "After a few days the blue mass, which first appeared to fill and distend the large segment of the pereion, gradually diminished, apparently deteriorating. It recedes first from the margin; in so doing it displays a series of layers, placed one before the other, lying across the animal. There were indications of these layers being divided by cross sections. The relation that this coloured mass holds to that of the ova which, at a later period, take its place, we know not; but we are inclined to believe that it is a reservoir of fat on which the animal is supported during the period of incubation.

We have not been fortunate enough to obtain embryonic forms of the larvæ so young as those figured by M. Hesse (plate 1, figs. 5, 6, and 7), which, by their single central eye and general form, resemble the larvæ of some entomostracous species of crustacea, a form that Dr. Fritz Müller contends, with some apparent show

of correctness, is the earliest stage in all crustaceous life. The ova are proportionately very large, and the parent retains the young after it has quitted the egg, until the young animal is scarcely less than half the length of the parent. M. Hesse has figured a specimen, in which he has represented all the larvæ placed within the ovi-pouch in a uniform manner, the head of each being directed towards the centre of the pouch; this is not in accordance with our observations, as, of the number of specimens that we have seen carrying young, we have found all with the young creatures variously placed, some with the head, others with the tail, directed forwards or across. When the young quit the care of the parent, nothing but a thin, transparent skin remains, and the parent probably dies.

The male differs from the female by the presence of a remarkable pair of mandibles directed forwards; fierce and terrible organs of prehension they must be, but they have always struck us as being organs that must be valueless in assisting the animal in feeding. After we had observed the structure of the oral organs of the female, we directed our attention to those of the male. In *A. maxillaris*,* on the under surface of the head, exists a pair of large two-jointed plates, the basal being subtriangular and large, the other small and apical. From its position and structure we consider this as the representative of the hooked appendage in the young animal, consequently the homologue of one of the pairs of gnathopoda; beneath this lies a pair of foot-jaws, in form very closely resembling those of the adult female. On removing these, we arrive at a crustaceous surface, with a minute and apparently imperforated tubercle in

* See the various details of the underside of the head and its organs represented in p. 190.

the middle. That the male animal should be without a mouth and digestive apparatus, we certainly were not prepared to find, since the presence of the mandibles, though unusually placed, induced us to expect the existence of a *prima via* as much as we had deduced its absence, from finding those organs wanting in the female.

The large lateral lobes of the cephalon are filled with muscles, which hold and move the powerful mandibles that can only exist as organs with which to grasp the female.

From the facts which have now been observed, assisted by the elaborate labours of M. Hesse, we have arrived at the following conclusions :—

1st. That *Anceus* of Risso and other authors, with a large head and porrected mandibles, is the fully developed male state of this genus.

2nd. That *Praniza* of Leach and other authors, with a small head, is the female state, either in an unimpregnated or gravid state.

3rd. That the larva form of the animals of both sexes, although closely resembling each other, may be distinguished at a very early stage of their growth, even if not immediately after birth.

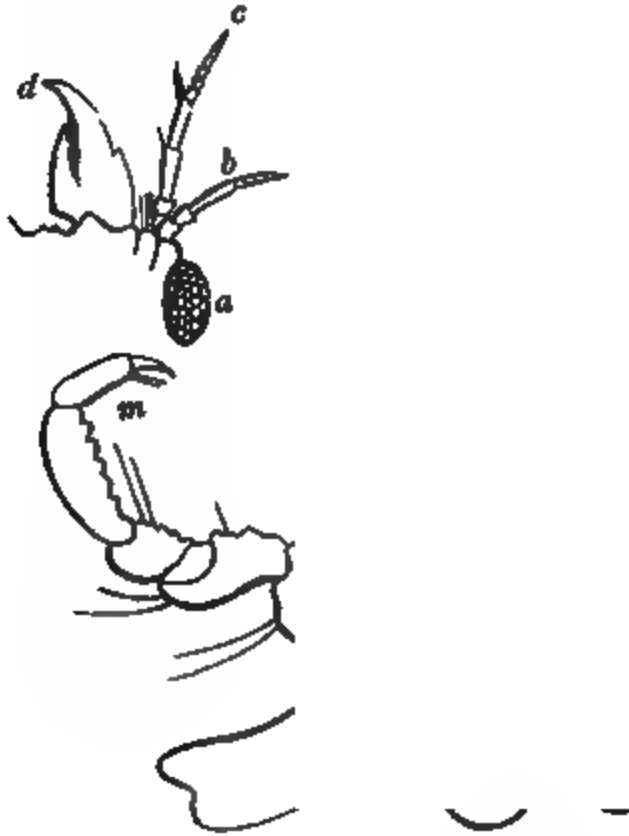
We hope that the conclusions at which we have thus arrived will be tested by close observers. There are also some points of interest in the internal structure of these animals that have yet to be worked out.

ISOPODA.

ANCEIDÆ.

ABERRANTIA.

T



ANCEUS MAXILLARIS.

Specific character. Male with the cephalon broader than long, dorsally depressed, especially in the middle and anterior part, and finely granulated on each side within the eyes; fore margin transverse, with a prominent tubercle within the mandibles, the centre itself having a much less prominent conical tubercle. Mandibles about two-thirds of the length of the cephalon, with a strong notch on the outer edge, and about ten denticulations on the inner edge, the apex forming a sharp tooth. The second pair of gnathopoda with the three or four basal segments soldered into a large flattened semioval plate, strongly ciliated on the inner margin. Male exserted organ very long and thin. Legs very finely serrated on the middle joints.

Female, with the second pair of gnathopoda strong, two-jointed, basal joint angulated; first pair of gnathopoda like those of the male.

Length $\frac{1}{4}$ of an inch.

(Male) *Cancer maxillaris*.

MONTAGU, Trans. Linn. Soc. vii. p. 65,
t. 6, f. 2.

Gnathia maxillaris.

LEACH, Enc. Brit. Suppl. Encycl. Method.
Crust. pl. 336, fig. 25.

Anceus maxillaris.

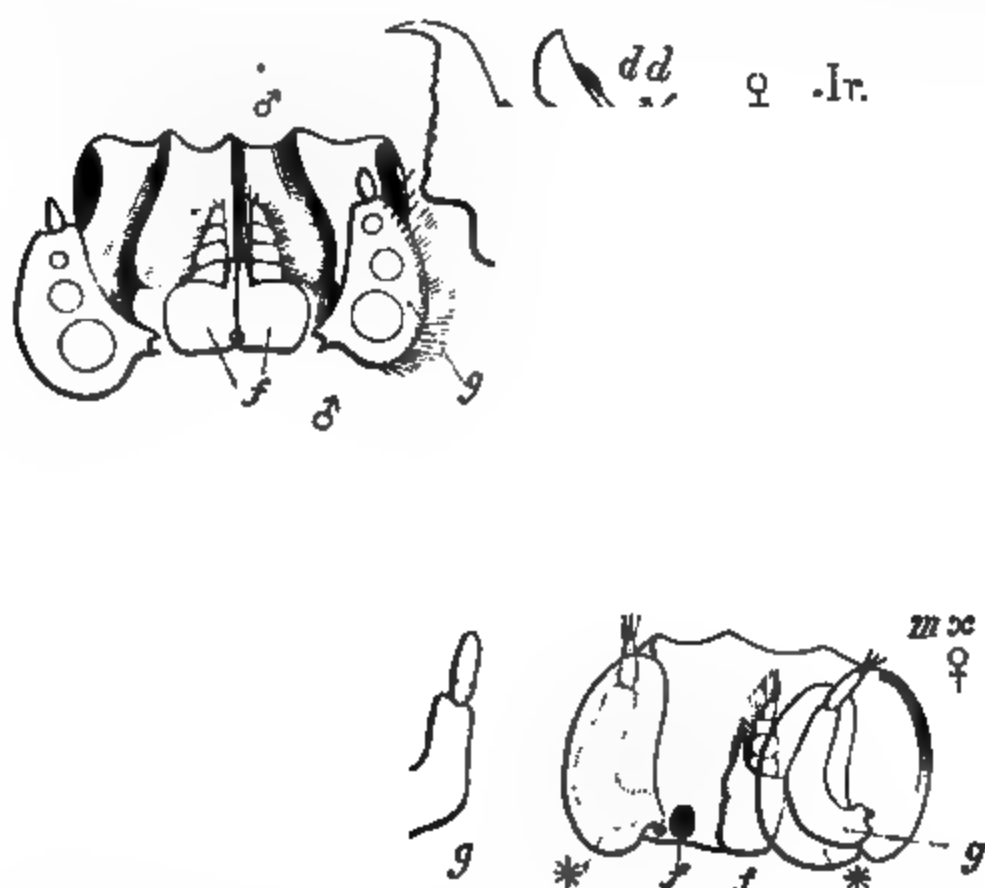
LAMARCK, Anim. sans Vert. v. p. 168.
DESMAREST, Cons. Crust. p. 283,

- t. 46, f. 6. WESTWOOD, *Annales Sci. Nat.* xxvii. p. 329. MILNE EDWARDS, *Crust.* iii. p. 197. WHITE, B. M. *Cat. Brit. Crust.* p. 74. *Pop. Hist. Brit. Crust.* p. 243, pl. xiii. f. 5. SPENCE BATE, *Ann. Nat. Hist.* ser. 3, vol. 2, pl. 7, f. 1, and details.
- (Male) *Gnathia termitoides.* LEACH, *Edin. Encyc.* vii. p. 402.
Anceus rapax ? MILNE EDWARDS, *Crust.* iii. p. 196, t. 33, f. 12. *Règne Anim.* Ed. Crochard *Crust.* pl. 62, fig. 3.
Anceus scarites ? HESSE, *Mém. Étrang. Acad. Sci.* t. xviii. p. 57, pl. 3, fig. 15, 16.
- (Female) *Oniscus cæruleatus var.* MONTAGU, *Trans. Linn. Soc.* xi. p. 16.
Praniza Montagui. WESTWOOD, in *Annales des Sci. Nat.* vol. xxvii. p. 327.
Praniza obesa ? LUCAS, in *Ann. Ent. Soc. France*, 1849, p. 465, pl. 15, f. 3.
- (Immat.fem.) *Oniscus cæruleatus.* MONTAGU, *Trans. Linn. Soc.* xi. p. 15, t. 4. f. 2. (Copied *Enc. Méth. Crust.* pl. 339, f. 28, with the incorrect name *Oniscus (Calino, Leach) thoracicus*, Mont.).
Praniza cæruleata. DESMAREST, *Cons. Crust.* p. 284, t. 46, f. 8. WESTWOOD, in *Ann. Sci. Nat.* xxvii. p. 326, t. 6, f. 5. MILNE EDWARDS, *Crust.* iii. p. 194, t. 33, f. 10. WHITE, B. M. *Cat. Brit. Crust.* p. 74. *Pop. Hist. Brit. Crust.* p. 240, pl. xiii. f. 4. SPENCE BATE, *Ann. Nat. Hist.* ser. 3, vol. 2, pl. vi. f. 4.
- Gnathia termitoides.* (Fem.?) LEACH, *Edinb. Enc.* vii. p. 402.

THE male of this species, figured in the preceding page, is distinguished by the large size of the head, which, together with the very prominent mandibular appendages, gives the animal a fierce aspect. The head is nearly square, and about the size of the three anterior segments of the body conjoined; it is slightly broader across the middle, the eyes occupying the anterior lateral margins, in front of which the head on each side is somewhat squarely truncated, the antennæ being affixed in front of

the antero-lateral angles thus formed: within the place of insertion of the antennæ on each side, the anterior margin of the head is somewhat porrected, and transverse, with a prominent tubercle on each side, the space between these two tubercles being emarginate, with a small prominence in the middle. The dorsal surface, of the anterior half of the head, is depressed, an evident channel running from the middle of the fore margin to the centre of the head, where it meets with a small posterior longitudinal carina, behind which is a very short transverse ridge (which may indicate the point of union of the two segments of the pereion soldered to the head). On either side, arising from the inner margin of the eyes, is a short slightly impressed fossa, the surface of which is more or less strongly granulated. The superior antennæ are about the length of the mandibles, slender, with two equal-sized basal joints, a longer third joint and a five-jointed flagellum reaching to the tip of the fourth joint of the lower antennæ, which latter are nearly as long as the head and rather thicker than the upper pair, with two short basal joints; a third and fourth joint, more robust and of nearly equal length (equalling that of the third joint of the upper pair), and a short flagellum of six articuli. The mandibles are of large size, being about two-thirds of the length of the head. They are nearly flat above, of a somewhat elongate-triangular form, with a prominent tooth in the middle of the outer edge, the apex prolonged into a curved tooth, and the inner margin armed with nine or ten small obtuse teeth; the inferior surface of the head is protected by a pair of large flat valve-like organs, each about half the size of the head itself (and which might be supposed to represent the second pair of gnathopoda (i), corresponding with the second pair of feet of the typical Isopods, but lettered *g* in the figures in

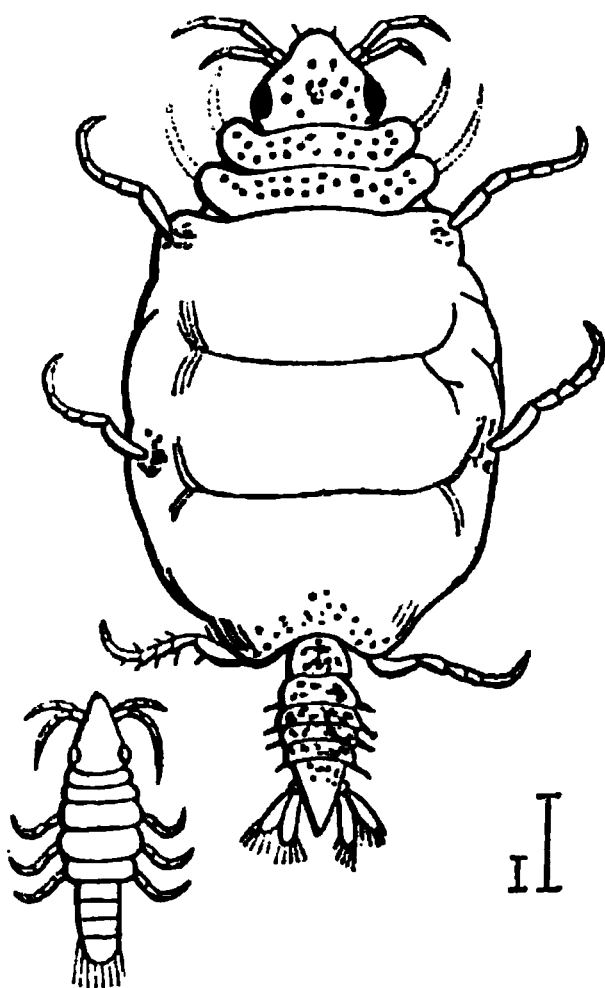
the following cut). Each valve is somewhat of an oval form, the outer edge nearly straight, fitting the somewhat triangular deep impression on the underside of the head: the inner margin of each valve is strongly ciliated, and



along the middle of the disc are three thickened circular calcareous masses (apparently representing the ossified centres of the three joints, of which this portion is probably composed). The somewhat pointed apex of each of these valves is furnished with a minute joint, setose at its tip. These valves are attached near the posterior lateral angles of the head; they are ordinarily shut together, their inner margins overlapping each other, so as to form an under covering of the head. Within them arises a much smaller and more delicate pair of appendages (possibly homologous with the first pair of gnathopoda) (h but marked *f* in the above figure), composed of a somewhat square basal piece, with its

inner apical angle produced into a slender elongated process, followed by four joints attached together obliquely, with a strong coating of bristles directed obliquely backwards along their outer margin. The first and second free segments of the body are about the same width as the head, short, transverse, with the sides rather rounded and dilated; the three following segments are somewhat narrowed, longer, much more irregular, and less distinctly separated from each other than the anterior segments, and with the lateral margins rounded and directed somewhat backwards. There is a small short transverse piece in the middle between the last segment of the body (pereion) and the first segment of the tail (pleon). The pleon is about equal to two-thirds of the length of the head, and consists of five transverse segments, followed by a triangular central terminal plate, each segment being furnished on each side beneath with two pairs of very delicate, strongly ciliated, branchial scales. The tail (pleon) is not half the width of the hind part of the body. The legs are of moderate length and rather robust, with some small tubercles on the inner margin of the middle joints.

The female, in its fully developed gravid state, as represented in the following page, is a little longer than the male, and has the body greatly swollen with eggs, or young; the head, anterior segments of the body, and tail being small, and marked all over with minute dark points. The head is subtriangular, without any appearance of the immense jaws of the male (of which, indeed, we have not found the slightest vestige). The upper antennæ are small, and consist of a short basal joint, followed by two nearly equal longer joints, and a short and slender terminal flagellum. The lower antennæ are much stronger and longer than the upper, and consist of two strong



basal joints followed by two longer ones, the fourth being somewhat larger than the third, and followed by a slender setose six-jointed flagellum. The inferior surface is covered by two pairs of appendages (the gnathopoda), the outer of which appears to consist of only two distinct joints, although traces may be observed of their being composed of several joints closely soldered together (fig. *g. ♀*). The first of these joints is rather wide, flattened, and considerably angulated beyond the middle, the basal half being more curved and the distal half nearly straight; this is followed by an elongate-ovate joint, setose at its extremity; and in certain positions we perceived an indication of a very minute apical articulation amongst the terminal setæ. Within this pair of appendages lies a pair of extremely delicate, flat membranes, which we have above regarded as the anterior of the incubatory scales, and within these are a second pair of appendages (first pair of gnathopoda), similar in form

and articulation to those of the male. We have found no other trace of mouth organs in these developed females. The two succeeding segments of the body are quite distinct, very short, and rounded at the sides, but the three terminal segments are consolidated into a large oval mass covered with delicate membranes, through which the eggs and young are plainly visible; the black eyes of the latter giving to this part of the body a speckled appearance, and showing at the same time that the arrangement of the young within the incubatory pouch is completely irregular; and we have never seen the symmetrical arrangement of the larvæ as figured by M. Hesse in the gravid female. The tail (pleon) and its appendages resemble those of the male, and the legs do not exhibit any more marked differences beyond being somewhat more slender. One of the young extracted from the pouch of the parent, and which attains to more than a third the length of the adult animal before it quits the ovi sac, is represented at the left hand side of the above engraving.

The state of these animals previous to arriving at complete maturity offers several circumstances sufficiently remarkable to account for the larger sized larvæ (if we may so term them) having been mistaken for fully developed females. It is this state which was first described by Slabber and Montagu, and also by Mr. Spence Bate, who confounded it with the adult animal, in the "Annals of Natural History" for September, 1858. The large mass formed by the consolidation of the three posterior segments of the body is of a very elongated oval shape, and in the individuals described by Montagu was of a fine blue colour; whence the specific name which he applied to it. It varies, however, not only in different individuals, but also in different states of the

respective animals. We have received them of a bright grass-green from Mr. Loughrin, of Polperro: blue from the crevices in the slate in Plymouth Sound, and have dredged them of an ash-grey, as well as transparent and dirty white, in five or six fathoms of water in the same locality.* "The varieties of colour," observes Mr. Spence Bate, "appear to be dependent upon the progress made in the advancement towards spawning, or in some way connected with the development of the ova. When the animal is blue, I have observed a double line of ova traversing the length of the enlarged segment. This I presume to be the ovary, or oviduct, previous to the escape of the ova into the incubatory pouch, which they ultimately fill to the apparent annihilation of the other contents of this part of the animal. I have watched specimens in a glass, and have perceived, after a few days, that the blue mass, which at first appeared to fill and distend the large segment of the pereion, gradually diminished. It recedes first from the margin; in so doing it displays a series of layers placed one before the other lying across the animal. There were indications also of these layers being divided by cross sections. The ova fill the pouch first, as seen in fig. 6, and ultimately, as shown in fig. 8 (copied in p. 177), where the embryo has considerably advanced towards completion. The blue appearance is now changed to brown—a circumstance that is due to the reddish pigment cells which mark the pereion of the young animal." Thus, at a period before the animal has acquired its final condition, in which the suctorial structure of the mouth is entirely lost, we find the ova to be present, but probably impregnation does not take place until the assumption of the final state.

* M. Hesse figures them also of a lemon colour, blood red, and sea-green.

We have no hesitation in referring the animals above described to the *Cancer maxillaris* of Montagu. His description is indeed very concise, and his figure very rude, but an examination of the specimens preserved in the British Museum Collection leave no doubt on this point, all the males having the notch on the outer edge of the mandibles, forming a small tooth.

Our specimens, moreover, have been found in considerable numbers along the Devonshire coast, in Montagu's localities. We are also able to state that Mr. Montagu was acquainted with the fully developed female, from an examination of his series of original drawings now in the hands of Mr. Parfitt of Exeter; whence we further learn that Montagu's variety of his *Oniscus cæruleatus*, having the body white, with the head, pereion, and pleon maculated with yellow (which Montagu shrewdly suggested might possibly be a sexual variation), is a fully developed female. The name, therefore, of *Praniza Montagui*, which Professor Westwood proposed for this variety, must sink into a synonym.

Mr. W. P. Cocks found the males in crevices of rocks at extreme low-water mark at Gwyllyn Vase, and in trawl refuse, whilst the *Pranizæ* he took most abundantly in the neighbourhood of Falmouth, and a specimen in the British Museum, labelled *P. flavus*, Bantham, Falmouth, is undoubtedly a female of this species. Montagu only obtained two specimens of his *Oniscus cæruleatus*, which were found adhering to the body of the *Father lasher* (*Cottus scorpius*) on the Devonshire coast. The late Mr. W. Thompson's collection also contains specimens of the males found amongst dredged matter at Bangor, in Ireland, in the month of August, and also upon Bangor oysters in the month of December. Mr. Norman also communicated to Professor Bell speci-

mens found on a stone brought up whilst haddock-fishing, and females found upon a shell of *Limitella communis*.

Mr. Robertson has sent us both male and female specimens from the Isle of Man, all taken under dead Balani.

We were at first disposed to regard our species as identical with the *Anceus manticora* of M. Hesse's memoir; but the details which he has given of that species do not agree with those which our specimens present, and which, consequently, induce us to refer the species rather to his *Anceus Scarites*, pl. iii. fig. 15; although we have certainly never seen specimens exhibiting the singular marking which he has represented: the large patch in the centre of the three conjoined segments of the body agrees, however, with the males of our species, except that in the latter this patch is only visible on the ventral surface. We believe, also, that our species is identical with the *Anceus rapax* of Milne Edwards,—as in fact that learned author has suggested,—although in his figure he does not represent the notch on the outer edge of the mandibles.

DOUBTFUL SPECIES.

ANCEUS (PRANIZA) FUSCATA.

Praniza fuscata. JOHNSTON, in Mag. Nat. Hist. v. p. 520, f. 99. WESTWOOD, in Ann. Sci. Nat. t. 27, pl. vi. f. 26. WHITE, B. M. Cat. Brit. Crust. p. 74. Pop. Hist. Brit. Crust. p. 241.

THE late Dr. Johnston indicated, as a distinct species of *Praniza*, certain individuals evidently in an immature condition, which he had taken on the Berwickshire coast, and which, in the present state of our knowledge of the species of this genus, it is impossible to assign to the real mature representatives. They are described as being two lines long, with the cephalon, two anterior segments of the pereion, pleon, and legs colourless and transparent, the eyes black, the large terminal consolidated mass of the pereion reddish-brown; the cephalon is pointed, the antennæ lateral, four-jointed, the last joint long and divided by many transverse lines; the eyes lateral, large, and compound, like those of insects. The pereion (which Johnston called the abdomen) is ovate, with a translucent edge and three pairs of legs. The pleon is straight, six-jointed, the joints equal, distinct, armed on the underside with four rows of compressed fins, ciliated on the margins, and the ultimate joint terminated besides with four similar appendages, and a triangular process (the telson) between them. The large pereion is in some specimens smooth

and even, but in others (one of which had been selected for the figure) it is raised at the top (or anterior part) into two oval bosses, that greatly resemble the elytra of a *Meloe*, and are beautifully punctured; the same parts are apparent on the visible surface of both varieties, but much smaller in that whose back is smooth. Dr. Johnston suggested this to be a sexual distinction.

The following vignette, kindly drawn for us by Miss Annie Wright, represents Balarcadden Bay, Howth, near which place Mr. Haliday obtained his specimens of this genus.

BALARCADDEN BAY, HOWTH.

ANCEUS (PRANIZA) MACULATA. •

Praniza maculata. WESTWOOD, in Ann. Sci. Nat. xxvii. p. 326, t. 6, f. 4-25.
GUÉRIN MÉN., Icon. R. An. Crust. pl. 27, f. 10, a, b.
MILNE EDWARDS, Crust. iii. p. 195. WHITE, B. M.
Cat. Brit. Crust. p. 74.

UNDER the name of *P. maculata*, Professor Westwood described, in his memoir on *Praniza* above referred to, certain immature individuals belonging to the group, which he had received in spirits from the Rev. F. W. Hope, in company with various small parasitic crustacea, collected on the coast of Shetland. These three specimens varied from one and a quarter to two lines in length, and, with the exception of the large consolidated hind pereionic mass, which was of a dark reddish-brown, were of a brownish-white colour, with a row of brown spots on each side of the five segments of the pleon, and with various small dots of the same colour scattered over the terminal segment. The largest and smallest individual agreed together in having the hind portion of the pereion of a texture identical with the rest of the body, and distinctly divided into three segments, of which the first was larger than the two others, whereas the third individual, intermediate in its size, had this portion of the body consolidated into a solid mass, resembling hardened wax covered with a fine membrane. The former individuals were considered to be males, and the latter a female; a suggestion which seems confirmed by what has been advanced in a pre-

vious page. That all of them were in an immature condition is evident from the careful analysis of the mouth, published in the memoir in which their description appeared, and which, together with the relative structures of the cephalon and pereion, and other characters, led Professor Westwood to consider that this genus, and several others equally abnormal, ought to form a distinct division, intermediate between the Amphipoda and Isopoda (such, indeed, as Dana has formed under the name of *Anisopoda*), displacing the Læmodipoda of Latreille (Caprellidæ), from the osculant situation which they had held in the classification proposed by that author.

ISOPODA.
ABERRANTIA.

ANCEIDÆ.



ANCEUS EDWARDII.

Specific character. Female with the three posterior segments of the body forming an elongate-ovate mass. Outer gnathopod minute, four-jointed, inner gnathopod very large, five-jointed, the basal joint not produced into a linear appendage at its inner angle, terminal joints densely ciliated on the outside.

Length, one-sixth of an inch.

Praniza Edwardii. SPENCER BATE, in *Annals Nat. Hist.* ser. 3, vol. 21, pl. vi. figs. 1, 2, and details.

UNDER this name have been described certain female individuals belonging to this genus, which had certainly arrived at the adult state, as proved, not only by the existence of fully developed larvæ within the incubatory pouch, but also by the structure of the mouth organs, which had entirely lost the suctorial form of the immature condition. These females are of a much narrower and more elongate form than the fully developed females of either of the other species described in this work. It is, in fact, owing to these animals being in the fully developed state that they possess "the more continuous and less graceful outline from the anterior part of the head to the posterior part of the pereion," which the author indicated as distinguishing these animals from the full-grown larvæ of *Praniza cœruleata*.

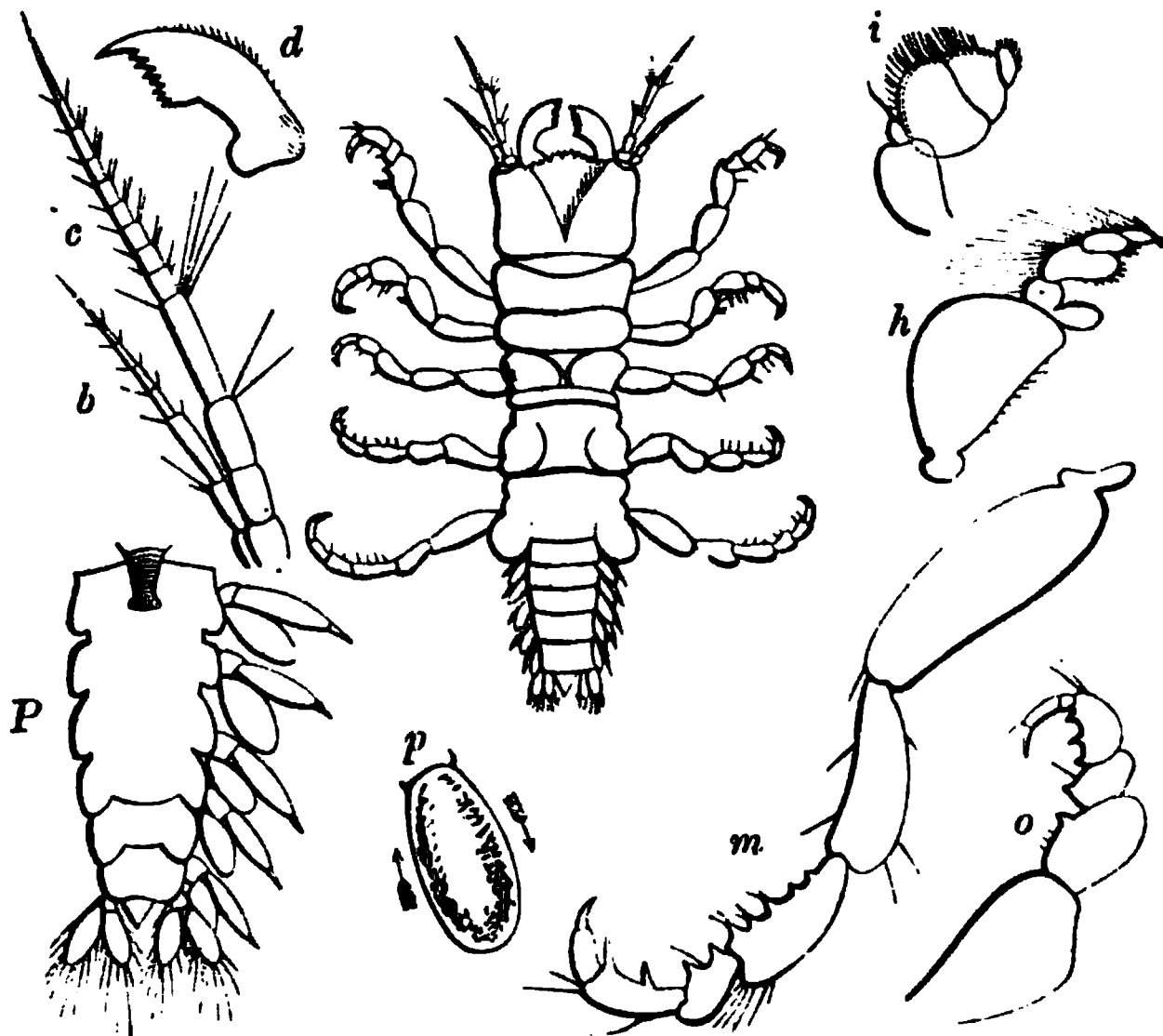
He also notices "the shortness of the pleon, and the smallness and more equal size of the pereopoda." The three organs on the right-hand side of the above woodcut represent first, to the left, the four-jointed outer foot-jaw, of comparatively very small size, the basal joint being large and curved, and the apical one very minute. The middle, scale-like, exarticulate piece clearly represents the scale, which is the homotype of those belonging to the incubatory pouch; and the large five-joint organ to the right is one of the inner pair of the foot-jaws which, in the female of *A. maxillaris*, is comparatively very minute, and which we have failed to discover in the female of *A. Halidaii*. The organ represented on the left side of our woodcut is the outer foot-jaw seen in a different position, in which the minute apical joint is not visible. These specimens were forwarded from Banff by Mr. Edward, in whose honour they were specifically named. One of them was charged with young, and a figure of one of the larvæ extracted from the incubatory pouch is represented in the left-hand figure of the woodcut upon p. 177. "It is a remarkable fact," observes the author in introductory remarks on the genus, "that in the young the organs generally bear a closer resemblance to those of *P. cæruleata* than to those of their own parent species." We are now able to account for this remarkable fact, from having learned that *P. cæruleata*, which we then considered as a distinct species in a fully developed condition, is only a full-grown larva of the preceding species.

Our knowledge of the present species must of course be considered as imperfect until its legitimate male is discovered.

ISOPODA.

ABERRANTIA.

ANCEIDÆ.



ANCEUS HALIDAI.

Specific character. *Male*, with the cephalon nearly square, the lateral anterior angles truncated for the insertion of the antennæ, middle of the fore margin produced into three broad divisions, of which the central is slightly porrected; margin finely serrated; antero-dorsal surface of cephalon very broadly concave; mandibles small, scarcely half the length of the cephalon, entire on the outer margin; second pair of gnathopoda composed of five broad joints. Male exserted organ rather short and thick; pereopoda with small spines on the terminal joints.

Female, with the outer gnathopoda five-jointed, narrower than in the male; inner gnathopoda wanting?

Length, one quarter of an inch.

Anceus formica? HESSE, Mém. Étrang. Acad. Sci. t. xviii. p. 39, pl. iii. figs. 5, 6, 7.

THIS species is at once distinguished from *A. maxillaris* by the very different structure and small size of the mandibles and foot-jaws in the males, and by the latter character as well as the (apparent) want of the inner pair of foot-jaws in the females. The head of

the male is somewhat quadrate in form, having the anterior margin more prominent than in the preceding species; the upper surface of the head is more broadly and regularly concave, and the mandibles are scarcely more than one-third of the length of the head; they are curved, with the tip produced into a sharp tooth, below which the inner margin is armed with about eight small, sharp teeth. When shut, these mandibles project but a small distance beyond the crenated fore margin of the head. The antennæ are about the length of the head, the upper ones being shorter and considerably more slender than the lower pair; the latter pair are composed of two strong basal joints, followed by a third joint, rather longer than the second; the fourth is still longer, rather thickened at the tip, where it is armed with several setæ, and is followed by an eight-jointed flagellum. The upper pair scarcely extends beyond the base of the flagellum of the lower pair. The outer foot-jaws are formed of a large basal joint, somewhat ovate-truncate in form, affixed transversely by its base near the posterior angles of the underside of the head; the remainder of the organ consists of four joints, forming a broad, somewhat oval, flattened mass, affixed so as to form an angle on the basal joint; the first of these four joints is small, and furnished with a strong seta on its inner angle, whilst the remaining joints are densely ciliated along the margin. The inner pair of foot-jaws differs considerably from the same organs in *A. maxillaris*, being formed of a large white, tumid, semi-circular basal joint, having a small lobe at its inner extremity, followed by four joints excessively delicate and thin in their texture, and furnished on the outside with long obliquely deflexed setæ. The head is separated from the first distinct segment of the body by a

very short transverse ridge, and the two succeeding segments are much shorter than the three posterior, which are irregular in the form of their lateral margins, the posterior angles of each of which is produced into a rounded lobe. The tail (pleon) is composed of six segments, of which the five anterior are furnished on each side with a double scale, the outer division being narrower than the inner, and terminated by a slender point, or short strong seta, whilst the inner division is oval, slightly ciliated at its margins, of a delicate transparent texture, allowing the circulation to be seen within, and which is carried round the organs within the lateral margins, as indicated by the arrows in the accompanying figure; the tail is terminated by a small triangular joint, furnished at each side with a pair of strongly ciliated, delicate elongate-ovate plates. The legs are more robust than in *A. maxillaris*, and have the terminal joints armed with several small spines.

The female closely resembles that of *A. maxillaris*, but is at once distinguished by the form of the outer appendages of the mouth (the head of this sex is represented in the upper right-hand figure of the engraving upon page 190). These organs are composed of five joints, of which the basal one is the largest, and is attached near the outer posterior angles of the underside of the head in a transverse direction, the remaining joints forming a somewhat oval flattened mass, of which the first joint is small and transverse, the next larger and semi-ovate, and the terminal joint very minute. We have not been able to discover any trace of the inner pair of foot-jaws.

This species was discovered by our friend Mr. Alexander H. Haliday, and is referred to in a communication dated October 9, 1847, which was published in the

“Annals of Natural History” (No. 5 for 1848, vol. i. p. 65), in which he remarks: “I found a species of *Praniza*, pretty common on the clayey shores of Strangford Loch, last week in company with *Anceus maxillaris* [*i. e.* the male of *A. Halidaii* above described]. They were in small cavities on the surface of the clay, under stones, sometimes singly, oftener two, or even three and four in each hole; the smaller slender green ones were few in comparison. You will find some of the new-born young with them having all the characteristic form of the parent, but the posterior thoracic segments not so completely confounded together.” Mr. Haliday furnished us with living specimens of both sexes and all sizes, captured at the end of February, 1856, amongst which, however, the males preponderated in number, the immature females being scarce at that period of the year, whilst in the summer they bore a fair proportion to the adult male, which was abundant enough. On the 14th March following, he observed in a letter to us: “It was only the other day I observed the notice in the ‘Comptes rendus’ of the Paris Academy, of Hesse’s observations on the identity of *Anceus* and *Praniza*. Notwithstanding their constant association, and the fact that the *Anceus* is always of pretty uniform size, and *Praniza* varies from about the same down to the smallest size, I should never have guessed that the latter was the larva of the former, and yet do not understand how to combine it with my positive observation of *Praniza* producing young, the very eyes of which (before birth) were visible through the transparent integuments of the parent.”

This Irish species appears at first sight most nearly to approach the *Anceus formica* of M. Hesse’s memoir. Our specimens, however, not only exhibit none of the

strongly defined coloration which his figures represent, but the outer pair of foot-jaws in the male of that species are formed of a large lunate exarticulate mass. The only other species, *A. brivatensis*, which M. Hesse describes as belonging to his first section (to which our Irish species seems to be referable), differs in the much broader head and in the strongly angulated sides of the two anterior segments of the body. Moreover, his figure of the underside of the male of *A. brivatensis* shows the outer foot-jaws as of so small a size as not closing the mouth, and "formée d'une lame large terminée à son extrémité par un petit appendice ovale et cilié."

In this indecision we have thought it more advisable to propose for this Irish species the name of the gentleman by whom it was discovered, and by whom so many interesting additions, in different tribes of annulose animals, have been discovered and most satisfactorily investigated.

ISOPODA NORMALIA.

THIS group comprises the great majority of the order which are distinguished by the nearly uniform size of the seven segments which compose the pereion, as well as of the seven pairs of legs attached to such segments. The cephalon is always distinct; the branchial organs are attached to the underside of the segments of the pleon, being closely connected with the pleopoda, and lie upon each other, being sometimes covered by a larger outer pair, in the more normal forms.

The *Isopoda normalia* constitute two principal divisions, founded upon the situation inhabited by the animals of which they are composed; the majority (*Aqua-spirantia*) residing, either free or in a parasitic condition, upon animals which live in the water, and consequently breathing oxygen from the water in which they live; whilst those of the other division (*Aero-spirantia*) reside on the land, generally indeed in deep situations, and breathe the free air by means of series of branchial plates, probably assisted by spiracles with which the branchiæ are furnished.

Division—AQUASPIRANTIA.

THE animals composing this division are likewise divisible into two tribes, according to the nature of their habits and the situations in which they are consequently found, being either 1. *Parasitica*, parasitic and fixed on other aquatic animals, or, 2. *Liberatica*, free, and crawling or swimming about in the water.

Tribe—PARASITICA.

The first of these tribes comprises the species which reside upon other crustaceans and fishes, and which may conveniently be subdivided in the following manner:—

1. Those in which the sexes are greatly dissimilar in form and size, and which are parasitic upon other crustaceous animals. Family—*Bopyridæ*.

2. Those in which the sexes are similar in general form and size, which are found parasitic upon fishes, and which are divisible into—

A. Those which have the base of the antennæ concealed beneath the porrected front of the head. Family—*Cymothoidæ* (of which no representative has hitherto been recorded as a native of our coasts).

B. Those which have the antennæ naked or but slightly covered at the base. Family—*Ægidæ*.

Fam.—BOPYRIDÆ.

THIS family (corresponding with the section *Epicarides* of Latreille, and the *Isopodes sédentaires* of Milne Edwards), although but of small extent, as to the number of the species of which it is composed, exhibits some of the most remarkable modifications of structure amongst its different members, whilst the characters of the group render it a very distinct one amongst the families of which the order is composed. So far as hitherto ascertained, the species are entirely parasitic upon the bodies of other crustaceous animals, especially those of the shrimp family and hermit crabs; species also of the genera *Galathea*, *Gebia*, *Gelasimus*, and even of *Mysis*, have been found to be infested by them.

The body, particularly of the female, is in most of the species of a much less firm consistence than in the majority of the order and in their full-grown condition, there is a marvellous difference in the size of the two sexes, the females being very large, ovate, or nearly circular in form, with the segments very indistinct, whilst the males are very diminutive and elongated, with the segments of the body quite distinct.*

In both sexes the antennæ are very short, and more or less rudimentary, consisting of only two or three joints in the *Bopyri*, but with a more distinctly articulated flagellum in some of the *Phryxi*. The mouth is very rudimental, consisting in the female and probably in the

* In this respect these insects offer a marked analogy to the family *Coccidæ* amongst hexapod insects. The female *Cocci* gradually lose their locomotive organs and become inert animal masses, capable only of suction and deposition of eggs, with which the body seems entirely filled.

male also of a pair of mandibles differentiated into a pointed siphon-like organ, the two appendages meeting together in a slight twist, and so strengthening each other as a penetrating organ, which is protected by one or two pairs of broad fleshy scale-like maxillæ; of which the first pair is generally bi- or tri-articulate, and the others almost without trace of articulation, and united for the most part to the under surface of the head by a small joint.

The legs are very short, having a broad hand strongly hooked at the tip for prehension; in some of the species the full-grown females lose the greater portion of these limbs. They are furnished with large incubatory plates on the underside of the body: in some species, however, they have the appearance of being recurved, and of covering the upper side of the animal. (*See Hesse, Ann. Sci. Nat.* ser. 5, t. iii. p. 237, where this, and t. iv. p. 226, where the reverse is stated to be the case.)

The tail (pleon) generally forms a distinct portion of the animal, and is composed of a series of short segments, which are often furnished with elongated lamellæ, or other analogous appendages, most conspicuous in the female.

The male is always very small, and much narrower than the female, with the head and seven segments of the body distinct, and each segment is furnished with a pair of short legs formed like those of the female, but more slender; the tail (pleon) is also more elongated, with the joints often distinct; the eyes are also distinct in the males, although only rudimental or wanting in the females.

The young of these animals are of an oval form, not unlike that of a wood-louse, having the segments of the tail of a comparatively larger size than in the adult state; in the typical genera they are furnished with two pairs of antennæ, of which the anterior are short, but the posterior

- pair are greatly elongated and furnished with very long terminal setæ, which are used as powerful organs of locomotion; the legs are short, but strong and prehensile, and the tail is furnished beneath, at the sides, with five pairs of flattened, oval, ciliated appendages, those of the sixth or last segment being elongated, and terminated by a pair of slender styles, which are armed at the tips with long setæ. They are very active in this state. Whilst in the character of the head, which projects beyond and above the antennæ, and in the form of the last three pairs of legs, there is a close approximation to the larval form of the parasitic Amphipoda forming the group Hyperina.

It hence appears that the earliest or larval conditions of these parasites is their highest and most advanced stage; the organs of sense and motion being proportionately larger and better developed at that period of their existence than ever after.

It would thus appear as if the nervous energy were then greater, and that the growth of both males and females is but, what Dana calls, a vegetative process, and one that is destructive of cephalization, which decreases in proportion to the growth of the animal. We therefore argue that, of the adult *Bopyri*, the smaller male ought to be taken as typical of the species rather than the more abnormal female.*

The two families proposed by Mr. Milne Edwards,

* This principle seems, indeed, capable of extension, since wherever amongst the Articulata an animal exhibits the sexual organs, or those which more especially characterize the sex, in an unusual state of development, the opposite sex is necessarily more decidedly typical of the group to which the species belongs. Thus, among moths, the immensely pectinated antennæ, and the more decided shape of the wings of the males, render the females better exponents of the groups to which they respectively belong than the males; whereas in the genera *Orgyia* among the moths, *Cebrio* and *Drilus* among beetles, *Coccus* among the Homoptera, in all which, for sexual purposes, the wings remain undeveloped, and the body becomes dilated to an enormous size filled with eggs, the opposite necessarily takes place.

Bopyriens and *Ioniens*, established upon the foliaceous or filiform structure of the appendages of the tail, cannot be maintained, as several genera have been lately discovered which are truly Bopyrideous, although furnished with filiform and even clavate caudal appendages. The genera *Prosthètes* and *Athelges*, parasites on the tails of hermit crabs (*Paguri*), are, in respect to the peculiar formation of their pleonic appendages, amongst the most remarkable of crustaceous animals. In *Ione*, these organs are singularly branched, resembling pieces of coral, and the incubatory plates are furnished with long clavate appendages. We have added the anomalous parasitic genus *Liriope* to this family (rather than place it near *Tanais*, as done by Dana), from a consideration of its general character. The entire want of limbs in the female, and the somewhat indistinctly articulated body of the males, with the pleon destitute of lateral terminal appendages, are very characteristic distinctions, separating it from the majority of the family, but, at the same time, removing it still farther from the *Tanaides*. The genus *Cryptothir* of Dana appears to us to be founded upon a carelessly examined male of a species of *Liriope*, as may be at once perceived by comparing Dana's figure of *Crypt. minutum* with our figure of *Liriope pygmæa*.

The family, at first, comprised only the genus *Bopyrus*, a separate family having been proposed for *Ione*, but more recent observations have fully proved, as stated above, not only that the two animals are closely united together by the intervention of several genera discovered since the publication of M. Milne Edwards's general work on the Crustacea, such as *Kepon*, *Phryxus*, and *Athelges*, &c., but that the genera *Gyge* of Cornalia and Panceri, *Dajus* of Kroyer, *Ledya* of Cornalia, and *Argeia* of Dana must be added to the family.

ISOPODA.
NORMALIA.

BOPYRIDÆ.

Genus—BOPYRUS, LATREILLE.

THE male of this genus is very small, narrow, and elongated, resembling an *Idotea* in its general form, but with only rudimentary antennæ, and with the pleon gradually narrowed to the tip and formed of six segments fused together, except at the margin, and apparently destitute of lateral appendages. The body is symmetrical in its shape.

The cephalon is distinct, transversely ovate, and furnished on the underside with two pairs of antennæ, the outer pair of which are composed of four short joints, terminated by setæ, whilst the inner pair are almost rudimental, and composed apparently of only two joints; the mouth is also almost rudimental, forming a conical point. The seven pairs of legs are of nearly equal size, and of considerable strength and thickness; they are affixed on the underside of the body, near the lateral margins, which are prolonged into rounded plates, and are directed, when at rest, towards the mesial line of the body, and terminated by a broadly ovate recurved hand, with a short, strong, bent claw at its extremity, employed for prehension.

The female is five or six times as large again as the male, being pear-shaped and unsymmetrical in its form, generally curved to one or the other side, and very much depressed, so that it assumes the appearance of a shield, having the lateral margins rather dilated and elevated, the lateral line of the segments being more

continuous than in the male. The head also is immersed in the anterior segment of the body, its front margin forming a continuous curve with that of the body. The antennæ are even smaller and more rudimental than those of the male, the outer pair being apparently only three jointed, and the inner pair only two jointed.

The mouth is comparatively rudimental in its structure, and is nearly concealed by a pair of oval operculiform foot-jaws, of which the anterior extremity is furnished on its inner edge with a small flattened and biarticulate appendage; beneath these foot-jaws and near their base are several minute lobes; the lower lip, on the contrary, is well developed, and forms with the labrum and mandibles a sort of conical sucker, the mandibles being minute, pointed, and scarcely movable.

The pereion is broad and flat, and the seven segments of which it is composed are closely soldered together, the lateral portions forming a rather strong border, beneath which are affixed the seven pairs of short, strong, prehensile feet, resembling those of the male in form. They are very small, so as not to extend beyond the sides of the body, and each is furnished at the base with a large plate-like appendage or valve, generally folded inwards, so as to form an incubatory pouch, which does not, however, entirely cover the central part of the underside of the body, leaving a wide open space, which allows the eggs and young to be seen; the anterior of these plates differs in form from the rest, and seems rather to be transformed into an appendage of the mouth, having its lower extremity obtuse, free and curved (fig. †).

The pleon in this sex is broad at the base, but narrower than the pereion, and gradually decreases in

breadth to its extremity, which is rounded, the six segments of which it is composed having the lateral margins thinner than those of the body; on the upper side the articulations are almost obliterated, whilst its lower surface is covered with five pairs of pleopoda, each consisting of a single membranous plate of a somewhat triangular form, the terminal segment being destitute of any lateral appendage.

The genus *Bopyrus* was established by Latreille in one of his earliest works, and was placed by him amongst the *Isopodous* crustaceans, being, in the first edition of the "Règne Animal," placed at the end of the order, with the view of showing what might be regarded as its organic degradation as compared with the other animals of the order. In the second edition of the same work, however, Latreille placed the genus at the beginning of the order, in a section termed *Epicarides*, with the view of bringing it into close connection with the *Cymothoades*, with which it has an evident affinity.

In 1772, M. Fougereux de Bondaroy published a memoir on *B. squillarum*,* in which he completely disproved the old fallacy entertained by fishermen on the coasts of France, that the *Bopyri* were the young of soles or other flat fish which took shelter under the shell of the prawn to protect them in the early state of their existence—an idea which even Deslandes had held and recorded in the Mémoires de l'Académie Royale des Sciences de Paris in 1772.

In 1837 some interesting observations upon the genus were published by Heinrich Rathke, "De Bopyro et Nereide. Rigæ et Dorpati," 4to; also in his work on morphology, "Reisebemerkingen aus Tamien."

* Hist. de l'Acad. des Sciences, 1772, p. 29, t. 1.

The females observed by him were five lines, and the males a line and one-third long. The former were invariably found upon female prawns, of which he had observed several hundreds thus infested, whilst quite as many male prawns which he had observed were found to be free from their attacks.

The mode of attachment of the parasites and the various and peculiar species of crustacea on which they subsist is worthy of some consideration.

They apparently work in pairs and only so, and from the following isolated observation would seem to do so from their earliest stages.

Some little time since, having been requested to examine some crustacea brought home from Australia, we found a shrimp (*Caridina truncifrons**) laden with ova, amongst which we perceived two specimens of the larva of a *Bopyroid* crustacean, a circumstance that appears to throw some light on the subject, by suggesting the supposition that the larval *Bopyri* first take shelter among the freely hanging ova previously to their finding their way beneath the branchial walls of the carapace, and so having quitted the care of their own parent, they are fostered by another, on whom probably at a later period they prey parasitically.

* Proc. Zool. Society, Nov. 24, 1868.

ISOPODA.
NORMALIA.

BOPYRIDÆ.

BOPYRUS SQUILLARUM.

Specific character. *Male.* Narrow, with the sides of each segment of the pereon produced into a flattened, rounded lobe. Pleon having the segments confluent. Antennæ concealed beneath the cephalon.

Female. Unsymmetrical, dilated at the sides. Pereiopoda small, strong, sub-equal. Anterior scales of the incubatory pouch curved, obtuse, and free.

Length of the male 1 line ; of the female 4 or 5 lines.

Bopyrus Squillarum.

LATREILLE, Hist. Nat. Crust. et
Ins. vii. p. 55, t. 59, f. 2.
Gen. Crust. et Ins. i. p. 67,
t. 2, f. 4. LAMARCK, Hist.
Anim. sans Vertébr. v. p. 164.
DESMAREST, Conn. Crust. p.
325, pl. 49, f. 8—14. GUÉRIN
MÉNÉV. Icon. B. Anim. Crust.
pl. 29, f. 2. BRULLÉ, Exped.
Morée, p. 46. MONTAGU,
Trans. Linn. Soc. ix. 106

- (*Oniscus* sq.). GOODSIR, in
Ann. Nat. Hist. xi. p. 75, pl.
7. MILNE EDWARDS, Crust.
iii. p. 282. WHITE, Cat. Brit.
Crust. (Brit. Mus.) p. 82.
Pop. Hist. Brit. Crust. p. 256.
Monoculus Crangorum. FABRICIUS, Ent. Syst. Suppl. p.
806. Bosc, Hist. Crust. ii.
216 (*Bopyrus* cr.).
Insecte qui s'attaché a la brevete. FOUGEROUX DE BONDAROV, Mém.
Acad. Sc. 1772, p. 29, t. 1.
(Var. ?) *Bopyrus Palaemonis*. RISSO, Crust. de Nice, p. 148.
LAMARCK, Op. Cit. p. 165.
DESMAREST, Crust. p. 326.

THIS species has long been known in consequence of its occurrence, during the summer months, beneath the carapace of the common edible prawn, the presence of the female causing a large tumour, of nearly half an inch in diameter, on the side where the parasite affixes itself. The female, in the ordinary condition, is flattened and broadly ovate in form, and the minute male is generally to be found fixed amongst the respiratory plates on the underside of the tail of the female. The male closely resembles one of the *Idoteæ* in miniature, having the body elongate and narrow, with rounded, flattened lobes at the sides of the segments of the body, and with the tail of a reversed, triangular form, rounded at the tip, with the six segments only indicated by five incisions on each side, being confluent on the disc. The antennæ are very short, and resemble those of the female, and the legs are also very short, although strong and chelate.

The female is broadly ovate, but having the pleon somewhat narrower than the pereion, flattened and curved either to the right or left,* according to the side

* This curvature is occasioned by the unequal pressure from the carapace of the prawn.

of the prawn to which it has been affixed; hence, in our right-hand figure, representing the dorsal view of the female, the head is seen to the left of a straight line, the lateral margins of the body to the right being distended, whilst those of the opposite side are contracted in a corresponding degree; the head itself does not project beyond the general outline of the body, which is almost continuous, and its anterior edge is rather sharp; the hind part is considerably contracted, and very deeply immersed in the anterior segment of the body; the eyes are wanting in this sex. The antennæ are very small, the outer pair being composed of three short, broad joints, gradually diminishing in size, the last terminating in a minute point, which may possibly represent the flagellum; the inner pair appear to be only formed of two distinct joints, of which the basal one is nearly circular.

The rudimental mouth is covered by a large pair of foot-jaws (maxillæ), flattened, with the inner margin (where the two meet together) nearly straight, the inner apical angle being provided with a small, nearly circular, lobe or joint, clothed with small hairs, and the base of this pair of foot-jaws is furnished with two or three membranous, flattened, pointed appendages. The anterior pair of the scales forming the incubatory pouch are transverse, and furnished with a large, flattened, curved lobe, of which the extremity is obtuse and incurved. The other scales are affixed within the base of the legs, the hinder extremity of each overlapping the succeeding scale.

The seven pairs of legs are of equal size and similar in form, being short and thick, having a broad, oval hand, terminated by a small finger. They are generally folded back and concealed beneath the lateral margins of

the body. The respiratory scales on the underside of the tail are short and transverse; the basal segment of the tail is much shorter than the following, the second and three succeeding being of equal size, whilst the sixth is rather narrow and nearly truncate, without any appendages.

The female when alive is of a pale greenish colour, glossy above, with the head and oral plates black, and those of the ovisac and under surface of the head black or very dark at their edges.

The young *Bopyri*, before they leave the incubatory pouch of the females, are ovate in form, and dorsally convex, resembling very minute wood-lice, with the outer pair of antennæ greatly elongated, composed of four joints, of which the first is short and robust, and the others elongated and terminated by one or two very long and slender setæ. The legs are broadly sub-cheliferous, especially the four posterior pairs, the three anterior pairs being rather more slender and directed forwards, whilst the four latter pairs are directed backwards. The respiratory scales of the tail (pleopoda) are strongly setigerous, the posterior pair being composed of a very short basal joint, supporting two elongated rami, pointed, and tipped with one or two terminal setæ.

The females of this species are attached to the outer lining of the branchial cavity of the common prawn, a single parasite being found upon an individual prawn. The fecundity of these parasites is very great, the eggs being retained within the incubatory pouch where they are hatched, and M. Risso states that he had counted as many as eight hundred young ones nourished by a single female.

Mr. Adam White, upon the authority of Col. Mon-

tagu, states that this species is common also under the carapace of the shrimp. It has not been our experience to meet with one, those that we have seen being obtained from prawns. From Guernsey and Jersey we have received them from the Rev. A. M. Norman, on *Palæmon serratus* and *Palæmon Leachii*, and from Polperro, where Mr. Loughrin has found them on *Palæmon serratus*.

The late Harry Goodsir published figures of a species of this genus, which he names *B. Squillarum*, representing the male, female, and young, which he had obtained from the carapace of a new species of *Hippolyte* (*H. ensiferus*) found in the gulf-weed between 25° and 30° north, and 40° west longitude. His figures, unfortunately, do not show sufficient care in their delineation, the segmentation of the body of the female being unintelligible, whilst the figures of the ambulatory legs of both sexes differ so materially from those organs in our English specimens, as to lead us to suppose that they cannot belong to this genus, but either to *Bopyroides* of Stimpson, or to *Gyge*.

ISOPODA.

BOPYRIDÆ.

NORMALIA.

Genus—GYGE, CORNALIA AND PANCERI.

Mem. Acad. Reale di Torino, Ser. 2, t. 19 (1861), p. 85.

Male. Cephalon as broad as first segment of the pereion. Pereion long and narrow, segments subequal in length. Pleon short and broad, segments distinct and subequal in length with those of the pereion. Eyes small and situated at the posterior part of the cephalon; second pair of antennæ well developed.

Female. Oval, anteriorly slightly unsymmetrical. Pereion, having the segments subequal, except the first two. Pleon having the segments distinct and subequal with those of the pereion. Antennæ rudimentary. Branchial appendages consisting of a series of small single sacs attached within the ventral lateral extremity of the several segments of the pleon, and a series of transverse folds between them. Posterior pair of pleopoda slightly developed.

THIS genus is certainly near *Bopyrus*, but differs from it in important structural conditions. It must also be very closely allied to the genus *Bopyroides* of Stimpson, which that author has formed for those species that agree in shape and structure with *Bopyrus*, but differ in their branchial features, in having "merely fleshy ridges instead of laminæ."

From the female *Bopyrus* and therefore also from *Bopyroides* this genus differs in shape, being roundly oval, and not having the pleon narrower than the pereion; moreover, in this genus the segments are distinct, in which it coincides with Stimpson's description of *Bopyroides*, whereas in *Bopyrus* they are all fused together in the central dorsal axis. *Bopyrus*, also, is unsymmetrical throughout,

whereas *Gyge* is only so at the anterior portion of the animal.

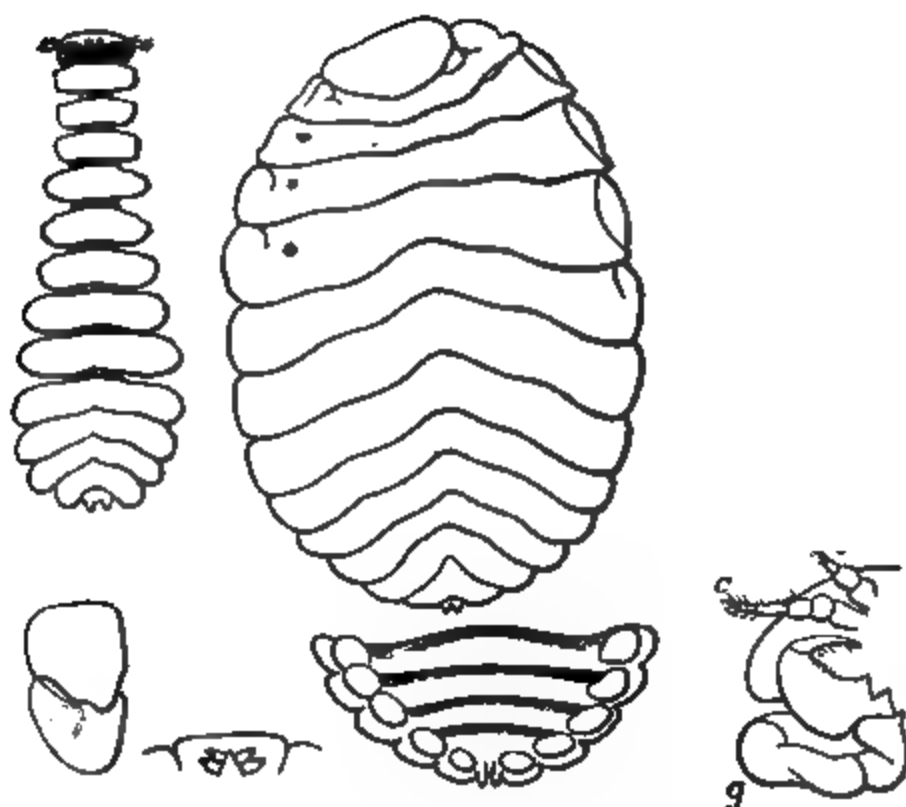
It also differs in the more rudimentary condition of both pairs of antennæ, and in the larger development of the ovigerous plates.

The male is in proportion much larger, being nearly one-half the length of the female. It has also the cephalon proportionately larger, and the antennæ, particularly those of the second pair, largely developed. The segments of the pleon are distinct, anteriorly being nearly as large as those of the pereion, and decreasing in length and breadth posteriorly very rapidly; whereas in *Bopyrus* they are fused together except at the margins, smaller than those of the pereion, and decrease gradually.

The larvæ of this genus appear to correspond very closely with those of *Bopyrus*, but appear to have the antennæ laterally nearer to one another.

ISOPODA.
NORMALIA.

BOPYRIDÆ.



GYGE GALATHEÆ.

Male.—Cephalon roundish, nearly as broad as the first segment of the pereion. Pereion increasing in breadth posteriorly. Pleon decreasing in breadth posteriorly, last segment bifurcate. First pair of antennæ short, three-jointed; second pair about three times the length of the superior, and terminating in a small flagellum.

Female.—Flat, oval, slightly unsymmetrical. Cephalon broad, pleon short and continuous with the pereion, terminal segment having a pair of pleopoda (posterior pair) projecting beyond its extremity and giving a bifurcate appearance to the posterior margin. Antennæ rudimentary. Branchial appendages consisting of small sacs near the margin of the ventral surface of each segment of the pleon.

Length of the male, three-twentieths of an inch.

„ „ female, eight-twentieths „

THE male gradually increases in breadth from the head to the last segment of the body (pereion), from which the segments of the tail rapidly decrease, thus giving the general aspect of a long narrow animal, with a large round

flat tail, which is the broadest part of it. The head is very nearly circular, flattened slightly at the anterior margin and cut off posteriorly by the first segment of the body, but still forming more than a semicircle. The first segment of the body is as long as and scarcely broader than the head; the lateral margins are square. The six following segments are of the same length as the first, but gradually increase in breadth and become more and more pointed at the lateral margins, as they proceed towards the posterior extremity. The first segment of the pleon is somewhat less in length and breadth than the last of the pereion. The remaining segments decrease until the fifth, which is very small, and forms with the sixth a small forked extremity.

The eyes are small, irregular patches of black pigment situated near the latero-posterior angles of the head. The first antennæ are small, and scarcely reach to the anterior margin of the head; they consist of two joints, each as broad as long, and a third that is much smaller and tipped with cilia. The second pair of antennæ are nearly three times as long as the first, and project beyond the lateral margins a considerable distance; they consist of five joints, and a minute triarticulated flagellum. The first three joints are subequal in length and diameter, the fourth is narrower and longer than the preceding, the fifth is still narrower and short, and appears to form the basal part of the small triarticulated flagellum, which supports, as well as the three preceding joints, a few short hairs. The organs of the mouth form a central conical process, but they have not been dissected out. The first pair of feet (first pair of gnathopoda) are large, strong and subchelate, the palm is concave, and the long curved dactylos impinges by the apex only against the dental projection of the posterior angle of the palm. The second and succeeding pairs of limbs gradually but

considerably decrease in the dimensions of the prehensile portion, and have the palm somewhat convex and serrated, the dactylos short and thick. There appears to be no distinct pleopoda or branchial appendages of any kind, but the thin lateral extremity of each segment appears to be considerably attenuated and to be traversed by numerous channels, which must necessarily assist very considerably in bringing the vital fluids into close approximation with the oxidizing influence of the water.

The female is oval, broad, but little more than half as long again as the male. Anterior portion of the animal only, unsymmetrical. Head partially fused with the first segment of the body, first segment short, the second scarcely longer, the five posterior segments subequal, longer than the first two. Those of the tail (pleon) gradually decrease until the sixth, which terminates in a small forked extremity, being the rudimentary condition of the posterior pair of pleopoda, which are so largely developed in the larval condition.

The eyes are wanting. The antennæ are rudimentary, each pair consisting of a single basal joint, not longer than broad, and an apical small spine or second joint. The oral organs converge to a point, and are situated below and between the antennæ; these are covered and protected by the maxillæ, and the oral appendages developed in the form of large fleshy scales, somewhat similar to but thicker than the ovigerous plates that spring from the base of every leg.

The pleopoda or branchial appendages consist of small sacs attached close to the under surface near the extremity of each segment, while a membranous ridge or fold reaches from one extremity to the other.

The young animal as it appears when just able to quit the parental pouch, is dorsally arcuate, the cephalon

anteriorly broad and projecting hood-like over the antennæ. The segments of the pereion are all present as well as those of the pleon, with which they are subequal, the last segment terminating in a central tubular process, the extremity probably of the alimentary canal. (See the upper right-hand figure.)

The eyes are small, irregular blotches, situated within the lateral and near the posterior margin of the cephalon. The first pair of antennæ are rudimentary, consisting of a basal joint of tolerably large proportions, and a terminal triarticulate flagellum. The second pair are more than half the length of the animal, and consist of three (or four ?) large joints and a terminal slender one tipped with four hairs, one of which is very long and strong and two very short. The four anterior pairs of legs have the propodos round and the dactylos short and curved, the three posterior pairs have the propodos long, narrow, and the dactylos straight. The last two differ from the antepenultimate in having the carpus produced along the inferior margin of the propodos to the posterior angle of the palm. The pleopoda are five pairs, and consist of a series of foliaceous plates tipped with an external long and an internal short hair. The posterior pair of pleopoda are biramous, each branch being biarticulate, terminating in a fine hair-like point.

The specimens from which these descriptions are taken were procured by the Rev. A. M. Norman at Herm, in Guernsey, on a specimen of *Galathea squamifera*.

With the exception of a difference in the habits of the species, the one above described seems (so far as we are able to judge from the description and figures of both sexes, given by Messrs. Cornalia and Panzeri in their elaborate memoir above referred to of *G. branchialis*, which infests *Gebia Venetiarum* and *littoralis*), scarcely

to differ from the Italian animal, agreeing therewith, especially in the peculiar form of the male.

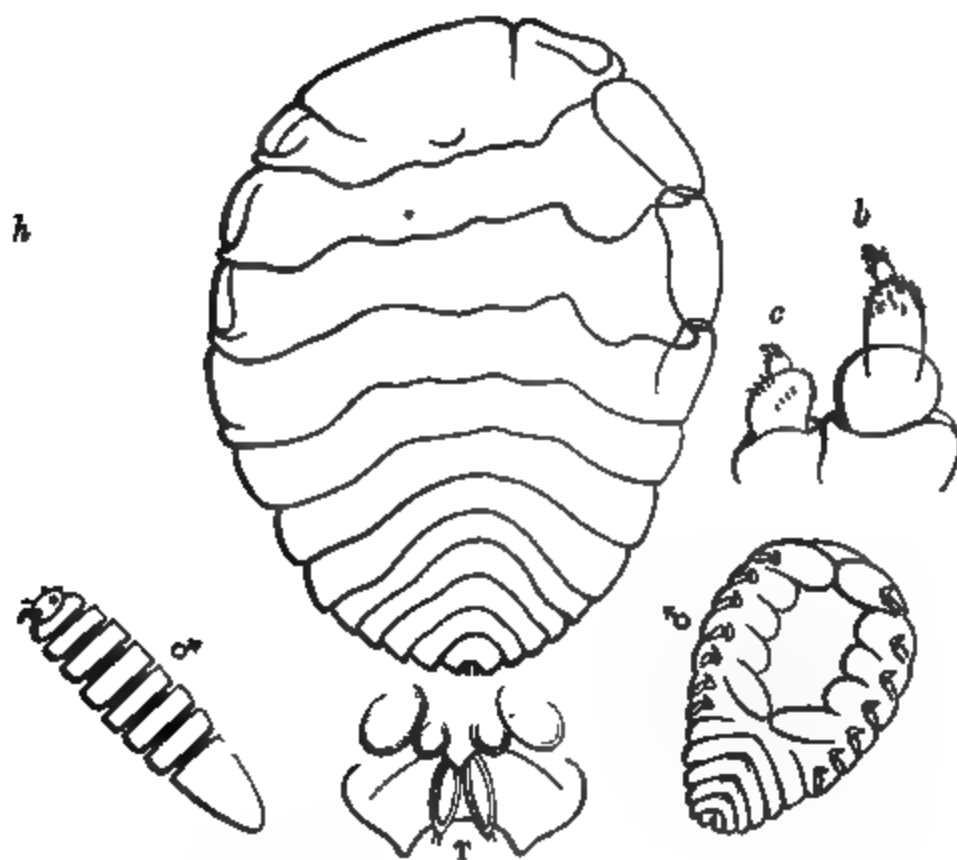
The following vignette of the Cliffs of Whitenore, in Weymouth Bay, has been kindly sent to us for this work by Mr. Thompson, of Weymouth.

•

CLIFFS AT WHITENORE, WEYMOUTH BAY.

ISOPODA.
NORMALIA.

BOPYRIDÆ.



GYGE HIPPOLYTES.

Male.—Sides subparallel; antennæ, advanced beyond the front of the head; segments of the pleon fused into an elongated ovate mass, obtuse at the extremity.

Female.—Broadly ovate, depressed, anterior portion slightly curved towards the left (when viewed dorsally); segments of the pereon and pleon distinct, sub-continuous; terminal segment apparently notched at the tip, owing to the projection of the posterior pair of pleopoda.

Length:—Female, seven-twentieths of an inch.

Bopyrus Hippolytes. KRÖYER, Grönlands Amphipoder Besck, p. 78, pl. 4, fig. 22. MILNE EDWARDS, Crust. 3, 283. WHITE, Pop. Hist. Brit. Crust. p. 256.

THE male of this species is narrow, with the sides of the body almost parallel; the head transversely ovate, with minute eyes and with the four antennæ short, conical, subequal, and advanced beyond the front margin of the head; the segments of the body are rather wide apart at the sides, and those of the tail are confluent, forming an

apparently inarticulate mass of an elongate ovate form, somewhat truncated at the base, scarcely with indications of divisions between the joints, the extremity being entire.

The female is broadly ovate, with the body slightly curved towards the left, the segments distinct, especially those of the tail, which is terminated by a small joint notched at its extremity, two minute pleopoda of an elongate-ovate form arising on its underside and having their ends visible within the emargination of the joint.

The head is broad, furnished on its underside with two pairs of minute conical antennæ, the inner pair consisting of three, and the outer pair of four joints, the penultimate of which is slightly setose, and the last terminated by a minute fascicle of setæ; the seven pairs of feet are small but robust, and of uniform size and shape, terminated by an elongate-ovate hand with a minute but strongly hooked finger; the two preceding joints being rather rugose at their extremities on the underside.

This species was first described by Kröyer, who detected it as a parasite on a species of prawn of the genus *Hippolyte* (*H. polaris*).

A specimen of this species is recorded as having been taken by the late Mr. W. Thompson, of Belfast, on the coast of Galway. The specimen belongs to the Belfast Museum, and is, unfortunately in a damaged condition.

Another specimen (of the female), which appears to us to belong to the same species, and which has supplied the central figure in the above woodcut, was forwarded to us from Polperro by Mr. Loughrin; our two lower-side figures being copied from Kröyer's figures of the male and underside of the female.

ISOPODA.

NORMALIA.

BOPYRIDÆ.

Genus—PHRYXUS, RATHKE.

(Phryxus and Pleurocrypta, HESSE.)

THIS genus was instituted by Rathke, for the reception of a species of the *Bopyridæ*, parasitic on a prawn of the genus *Hippolyte*, remarkable for the very swollen and unsymmetrical form of the female, of which the legs on one side are nearly abortive in the full-grown state, but more especially for the large size of the lobes or plate-like branchial appendages of the tail, by which it at once differs from the two preceding genera.

The whole of the species hitherto discovered, including three new ones now first made known to the public, are parasites on various crustaceous animals belonging to the Anomourous and Macrourous divisions, including not only the more typical *Hippolyte*, but also the aberrant genera *Pagurus* and *Galathea*.

The male in the species which served for the establishment of the genus is very minute and elongated in form, with the head transversely ovate, with two minute dark points indicating the eyes; the upper antennæ are very minute, and consist of three joints of equal length, but gradually becoming more slender to the tip, which is furnished with a number of hairs; the lower antennæ are much longer, and consist of eight joints, also gradually attenuated to the tip. The mouth is transformed into a small conical protuberance rising from a semicircular space. The pereion is composed of seven segments of nearly equal size, each with the sides rounded and wide apart (in specimens distended from having been

immersed in spirits), hence the body is nearly parallel at the sides.

Each segment bears a pair of rather strong legs, formed for walking, terminated by a semi-ovate hand, with a sharp hook-like finger.

The pleon forms a subconic-ovate mass, with all the segments closely soldered together, indicated more or less distinctly by lateral incisions.

The full-grown female is a large inert nearly globular mass, with the segments scarcely indicated by depressions, and with a series of wide and broad ovigerous plates, which fold backwards and envelop the upper-side of the body.

The cephalon is furnished with very short antennæ, resembling those of the male in structure, and the mouth forms a large conical tubercle rounded at the extremity.

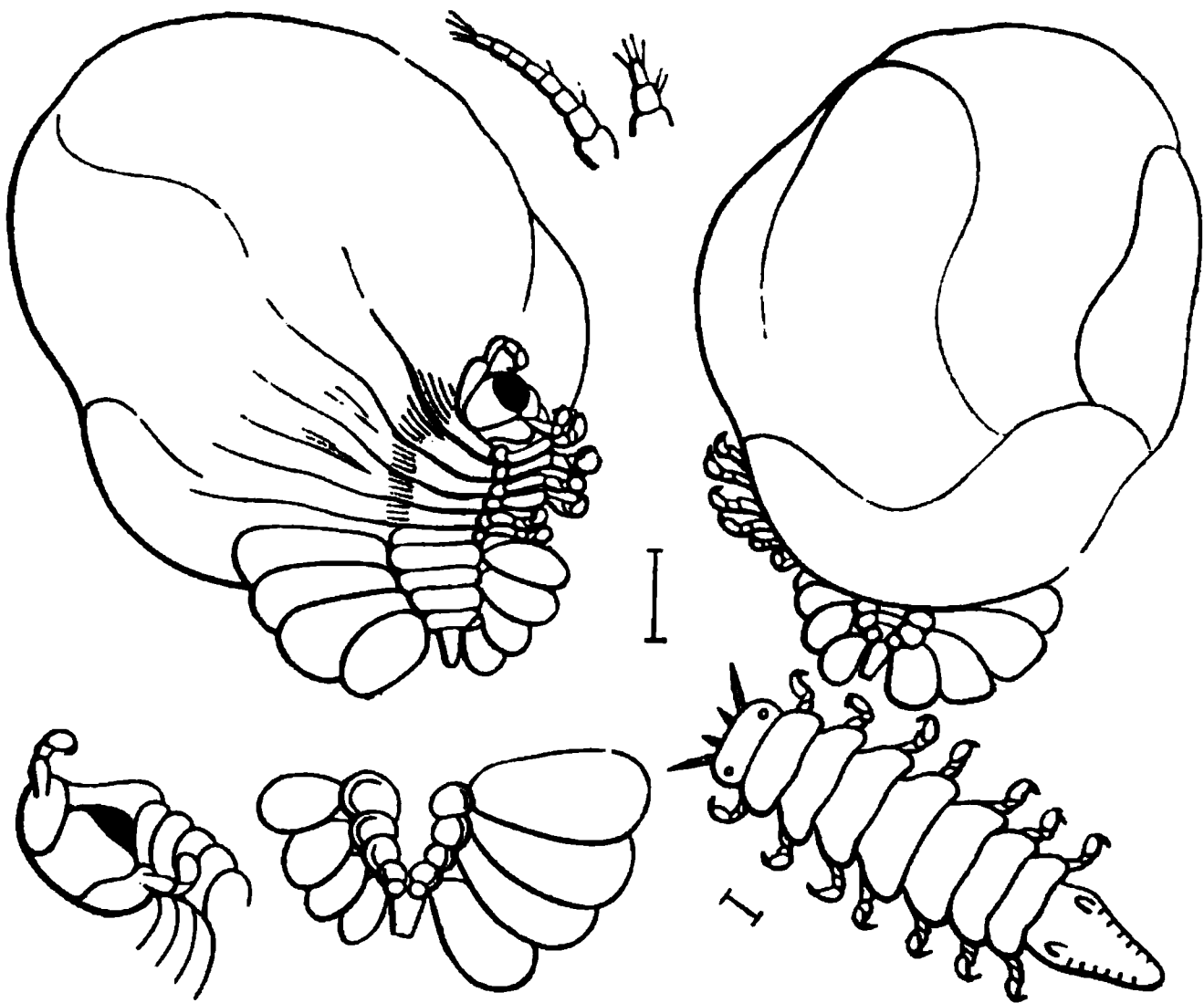
The pereiopoda are inclined towards the back, and formed as in the female *Bopyri*, with the articulations much less distinct than in the males, and the propoda are small and weak, with a small curved obtuse dactylos. These limbs are irregular in size on the two sides of the body, some of them being even obsolete on one or other side.

The pleon is composed of small joints, furnished with elongated lobes or plates for breathing, varying in number and size in the different species, the terminal joint being small and bifid in the typical species.

We have added to the genus several species, the females of which possess more or less elongated appendages to the segments of the tail, but differ from the typical species in having the body in the same sex symmetrical, or nearly so; on this account one of these species has been formed by M. Hesse into the genus *Pleurocrypta*, which we have not thought necessary to retain.

ISOPODA.
NORMALIA.

BOPYRIDÆ.



PHRYXUS ABDOMINALIS.

Male.—Upper antennæ very short, three-jointed; second antennæ eight-jointed, gradually attenuated to the tip. Oblong, subdepressed, with the pleon produced into a short blunt point.

Female.—Subglobose, very unsymmetrical, with the pereipoda on one side of the body almost obsolete. Pleon furnished on each side with four large oblong-ovate fleshy lobes; terminal segment minute.

Length of male, one-tenth, of female, one-quarter, of an inch.

Bopyrus abdominalis. KRÖYER, Natur. hist. Tidsk. iii. p. 102—, 289, pl. 1, 2 (1840); Voy. Scandinav. Crust. pl. 29, fig. 1.

Phryxus Hippolytes. RATHKE, in Nova Acta Acad., Nat. Curios., xx. p. 40, tab. 2. figs. 1—10. WHITE, Pop. Hist. Brit. Crust. fig. 257, pl. xiv. fig. a, male; b, female (1843).

THE male of this species is extremely minute, and is generally to be found partially immersed between the folds of the posterior part of the body of the female. The head is transversely ovate, with both pairs of antennæ visible in front.

The mouth in the full-grown male, in which probably but little food is taken, is reduced to a small conical fleshy lobe on the underside of the head.

The seven segments of the body are quite distinct, and the seven pairs of legs are affixed near the sides of the body beneath, and may be extended considerably beyond the sides, although generally hidden by being folded inwards close to the sides when at rest.

The tail forms a subconical piece, having all its segments closely soldered together with very slight indications of the articulations.

The female, when full-grown and distended with eggs (of which the number is immense), forms a large, nearly globular, mass, with one side of the body swollen to such a degree that it extends far beyond the limits of the head, absorbing the legs on this side, with the exception of the most anterior. This is exhibited in the lower figure on the left-hand side of our woodcut, where the mouth is indicated by the small dark-shaded portion resting on a somewhat heart-shaped base, having a leg with a dilated basal joint on either side, that of the right side succeeded by a series of folds, within which are attached the bases of the succeeding legs, whereas those of the left side are obsolete. These legs are slender, and terminated by an oval hand with a weak and curved finger, obtuse at its tip.

The sides of the body of the female are provided with very large scales, not arranged in pairs, and which fall backwards so as to cover the body.

The tail consists of five segments, of which the four basal ones are short and narrow, having on either side a large and a small fleshy lobe of an oval shape, but varying in size according to the side of the body to which they are attached; being the largest on the dilated side. The

terminal segment is minute, and unfurnished with appendages. In Rathke's dorsal figure of the species this segment is represented as bifid, but in the ventral one as entire, as appears also to be the case in our individuals. We have no hesitation in regarding our specimens as identical with *Bopyrus abdominalis*, elaborately figured in all its details by Kröyer in 1840, which is represented by him as attached to the under surface of the pereion of a species of Prawn.

The young of this animal is oval and very convex, with very slight indications of articulations; the head is large, with two dark round spots indicating the eyes; the upper antennæ are short and apparently exarticulate, whilst the lower pair of antennæ are about half the length of the body and six-jointed, with a pencil of terminal hairs. The body is furnished beneath with six pairs of strong subcheliferous legs, and the hinder part of the body, representing the tail, is provided with five pairs of flattened elongate-ovate plates, strongly ciliated at their extremities, the small obtusely triangular terminal segment being, moreover, furnished on each side with a larger curved lobe, bisetigerous at its tip.

This species was first detected by Herr Rathke as a parasite beneath the shell of a species of *Hippolyte*. We are indebted for our knowledge of it as a British species to Mr. Frederick Bond, an excellent ornithologist and entomologist, who obtained both sexes from the underside of the tail of the white Shrimp of the Sussex Coast, *Pandalus annulicornis*, in the month of April, 1846.

Mr. Alder has also obligingly forwarded to us a specimen of the male on *Hippolyte Barleei*, taken at Cullercoats, on the Northumberland Coast. So firmly was the little parasite attached to the ventral surface of the pereion between the fifth pair of pereiopoda, that it was

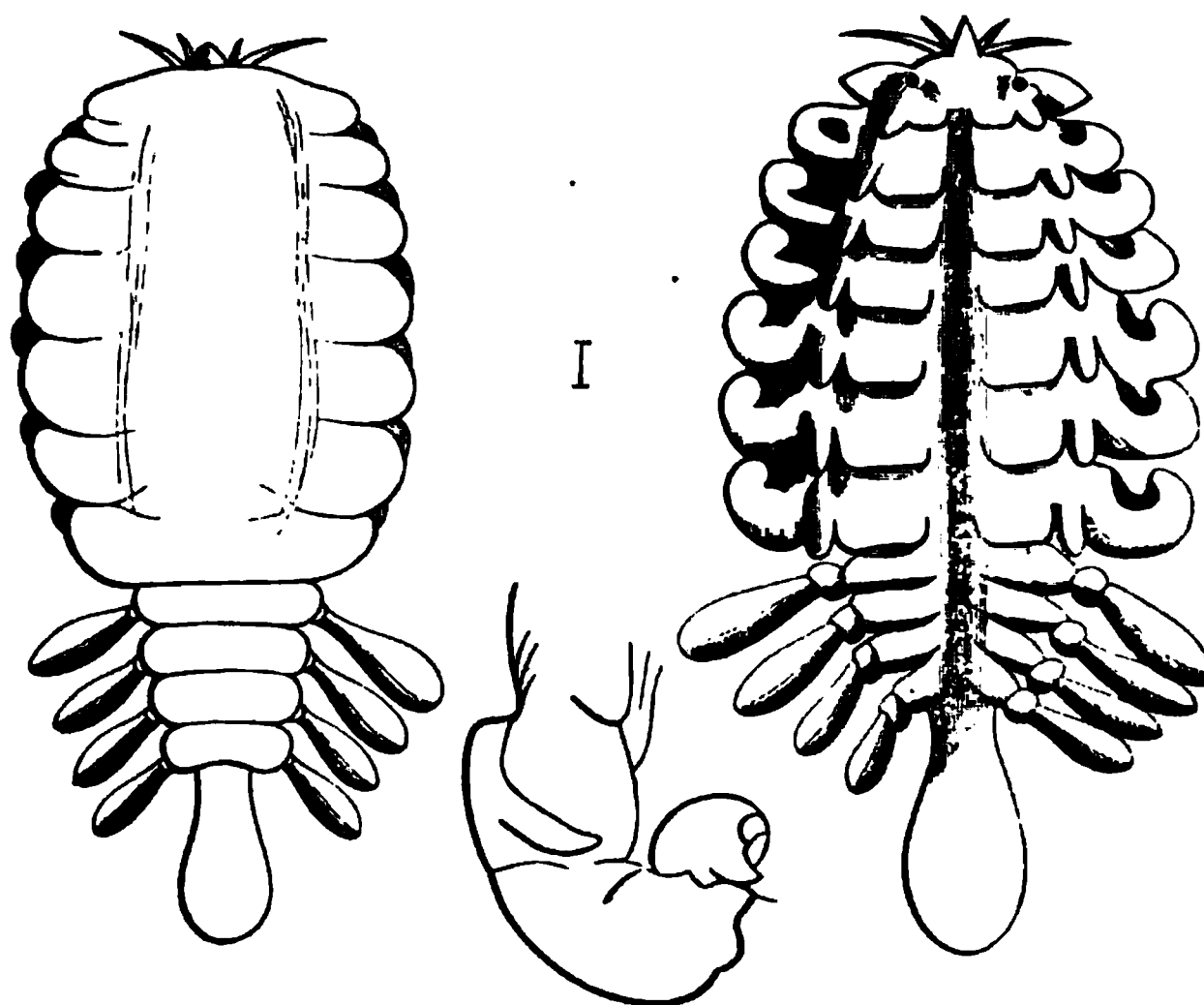
necessary to remove the creature with an instrument. This abnormal position was evidently one of some duration, for there had been no female attached to the *Hippolyte*, and the parasite, instead of being white and bleached as these creatures generally are, was of a reddish brown, and of hard structure.

The following vignette is a sketch of the Bay of Bayndie, near Banff, taken by Mr. Greig from the Elfkirk.

It is in this bay that many of the observations on the Crustacea were made for us by Mr. Edward, to whom we are indebted for the next species.

ISOPODA.
NORMALIA.

BOPYRIDÆ.



PHRYXUS FUSTICAUDATUS.

Female.—Oval, nearly symmetrical, the segments of the pereion clearly indicated by lateral incisions; antennæ, prominently seen beyond the fore margin of the head; pereiopoda swollen, with indistinct segments terminated by a small claw with a minute dactylos. Pleon well defined, composed of four segments narrower than those of the pereion, and furnished at the sides with four elongate-clavate simple lobes; terminal segment forming an elongate-oval mass.

Length, one-tenth of an inch.

THE small but increasing size of the few specimens of this species which we have hitherto seen, all of which are females, their symmetrical form, and the want of development of the scales in which the eggs are enveloped, lead us to suppose that the individuals before us are not yet arrived at the full growth. The curious lateral appendages at the sides of the tail are more strongly developed than in any other species we have yet seen, and their number agrees with that of the same organs in *Ph. Hippolytes*.

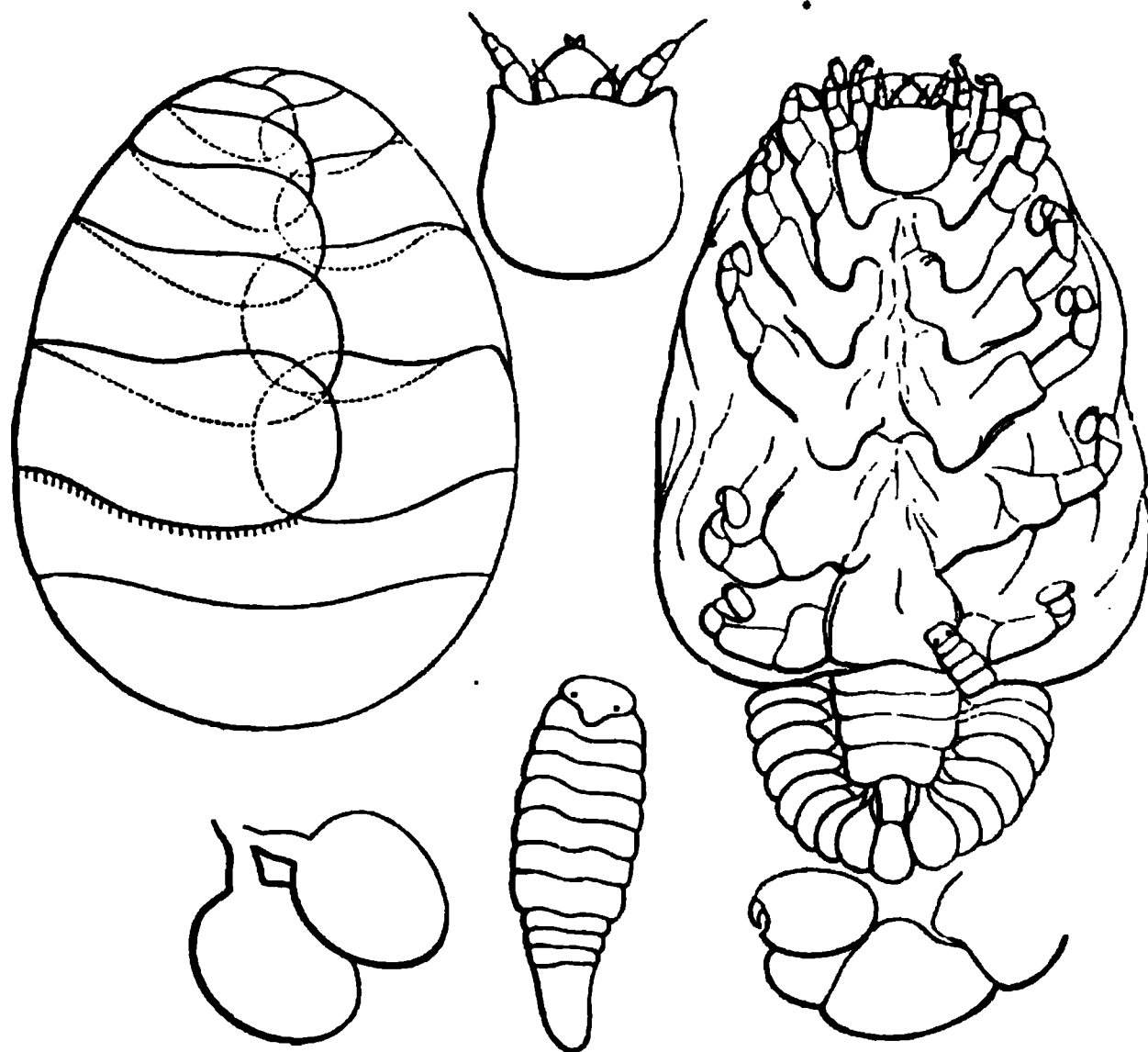
The head is broadly semicircular in form, the middle of the anterior margin produced into a conical lobe representing the organs of the mouth, at the sides of which are affixed the two pairs of antennæ, varying in length as above described in the characters of the genus.

The body is oval, with the sides symmetrical, the segments well marked by incisions, with the sides of the segments themselves rounded; on the underside the seven pairs of swollen obtuse feet are affixed, near the sides of the body, each being terminated by a small claw with a minute obtuse finger. The four basal segments of the tail are very much narrower than those of the body, and become gradually narrowed to the fifth or terminal joint, which forms a large clavate mass; the sides of each of the four basal segments of the tail are furnished with a pair of elongated clavate appendages for breathing.

We have only seen three specimens of this species, which were discovered by our valued correspondent, Mr. Edward, of Banff, attached to the branchiæ of the common Soldier Crab, *Pagurus Bernhardus*, on the 12th December, 1864.

ISOPODA.
NORMALIA.

BOPYRIDÆ.



PHRYXUS PAGURI.

Male.—With the cephalon nearly as broad as the joints of the pereion, with two minute eyes. Antennæ and pereiopoda not porrected in the front or extending beyond the sides of the body. Pleon narrower than the pereion, having the three anterior segments indistinctly defined.

Female.—Broadly ovate, nearly symmetrical, with very large ovigerous scales. Pereiopoda robust, of considerable size, equally developed on each side of the body. Pleon with the four anterior segments defined; each provided on each side with a pair of subglobose lobes attached by short foot-stalks to a common slender base.

Length of the male, one-eighth of an inch; of the female, nearly half an inch.

Phryxus Paguri. RATHKE, in Nova Acta Acad., Nat. Curios., xx. p. 57, tab. 1, figs. 13-15, male; tab. 2, figs. 11, 12, female.

Our figures of this species are copied from a very careful series of drawings, made by our friend Mr. Robert Templeton, from specimens taken from a *Pagurus*, dredged off Bird Island, Strangford Lough, in from eight to ten fathoms deep, with a muddy and shelly bottom, by Mr.

G. C. Hyndman, August 16, 1848, corrected by an examination of Mr. Templeton's specimens.

The male is very minute, elongate-ovate, with the tail more slender and indistinctly articulated. In Rathke's figure, the segments of the body are represented as much more widely separated from each other at the sides than in our specimen, the anterior lateral angle of each segment being rounded, and the middle of the hinder margin more rounded behind; the upper antennæ are very minute and three-jointed, the lower pair are longer, and seen beyond the lateral margin of the head; the legs are small, terminated by a small ovate hand with a minute hook-like finger (dactylos).

The female is large and unwieldy, with very large ovigerous scales. The body is but slightly unsymmetrical, nearly oval in form, with the ovigerous scales very large and thrown over the back, entirely concealing the body, limbs, and tail of the animal, where the latter is incurved; the head is oval, with the inner antennæ very small, composed of a thick basal joint and a minute terminal one; the outer pair are much larger, apparently three-jointed, terminated by a thin bristle. The legs are well developed on each side of the body; they are strong and terminated by an oval hand, having a minute emargination for the reception of a small finger. The tail is composed of four transverse segments, each furnished on each side with a pair of nearly globose lobes, fixed by short footstalks to a short and slender base. The tail is terminated by a small joint supporting a single lobe like the rest, so that there are seventeen of these appendages in all.

Our figures represent the upper and under sides of the female, with the head, one of the feet, and a pair of the lobes of the tail, and the minute and slender male.

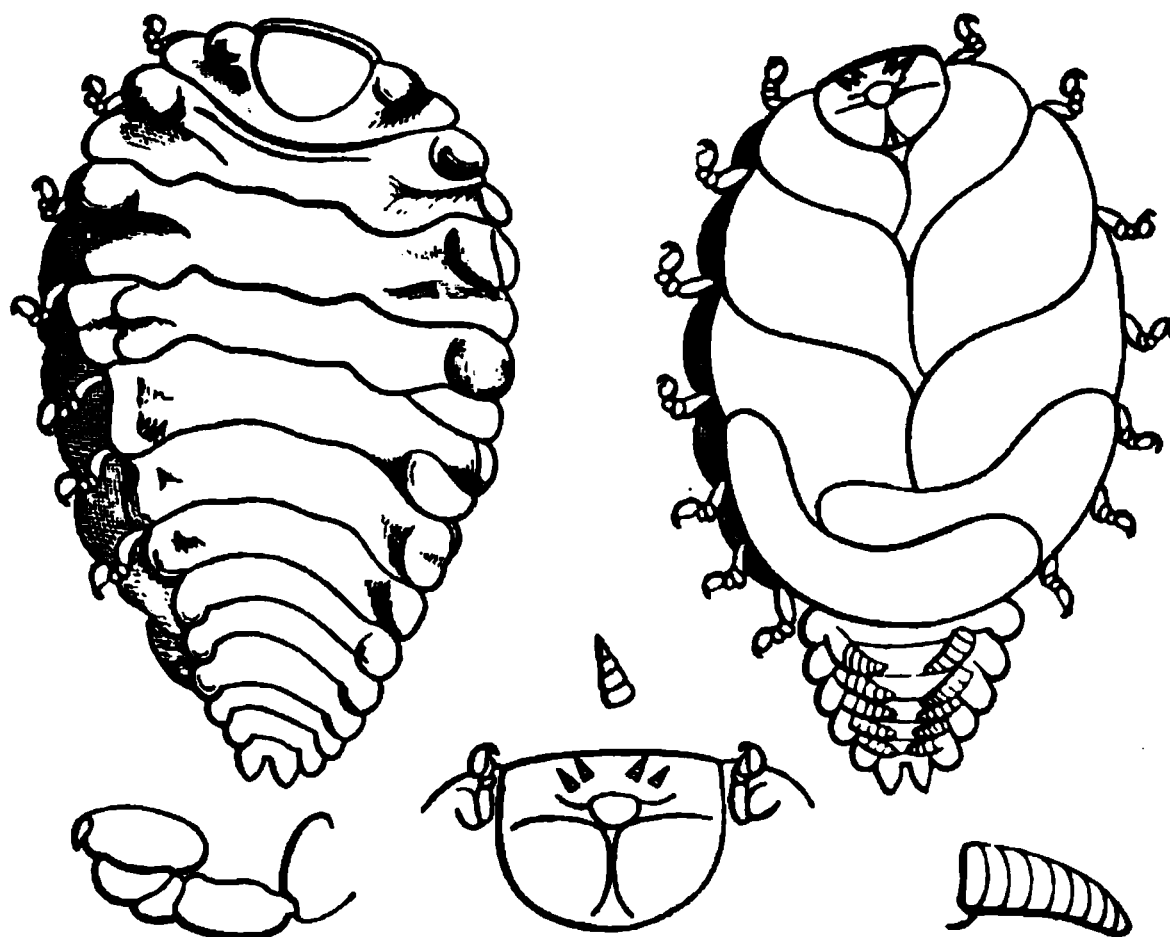
In addition to Mr. Templeton's specimens, we have received the male and female of this species from Polperro, collected by Mr. Couch, as well as a coloured drawing of a specimen which we also consider to belong to this species from St. Andrews; having been taken by Mr. McIntosh. It was first found by Rathke upon *Pagurus Bernhardus* on the Norwegian shore.

Athelgue fullode of M. Hesse, Ann. Sc. Nat., ser. 4, vol. xv. p. 97, pl. 9, appears to us to belong to this species.

With reference to the question how the Bopyrus can survive when the crab throws off its exuvium, Dr. Fritz Müller writes to us—"When the crab casts its skin, there can be no doubt but that the *Bopyrus* must go along with it; but as the crab, immediately after exuviation, is in an almost helpless and motionless condition, I think that the Bopyrus may crawl again into the branchial cavity. I shall send you a *Porcellana*, the integuments of which are so soft that it must have moulted very recently, and notwithstanding it has a very large Bopyrus in its branchial cavity. Moreover, it seems to be impossible that the considerable deformation of the carapace of the crab produced by the Bopyrus could disappear by exuviation; but I never found a deformed carapace without the Bopyrus, although I have examined more than a hundred Porcellanæ bearing the parasite."—"I may here observe, in *Bopyrus Porcellanæ* the right side is more developed than the left when the parasite dwells in the right branchial cavity, whereas the left side is the larger when the Bopyrus dwells in the left branchial cavity. The Bopyrus being fixed with its head directed backwards naturally in the right branchial cavity, the right side of the parasite can freely extend downwards, and therefore becomes larger."

ISOPODA.
 NORMALIA.

BOPYRIDÆ.



PHRYXUS HYNDMANNI.

Female. Flattened above, ovate in outline, but slightly unsymmetrical. Pereiopoda equally developed on both sides of the pereion. Pleon having six segments, the segments being but little narrower than the hinder segments of the pereion, each furnished at each side with a flattened, rounded-oval scale or lobe, the two attached to the posterior segment being rather more pointed; on the underside are two rows of elongate, conical, fleshy lobes, obtuse at their tips, and slightly wrinkled transversely.

Length, about one-third of an inch.

WE are only acquainted with a single female individual of this species, found attached to a *Pagurus* obtained at Groomsport, Ireland, from ten fathoms depth, by Mr. G. C. Hyndman, on the 24th of May, 1851, and by him presented to the late Mr. W. Thompson, in whose collection it is still preserved. From *Phryxus Paguri* it is at once distinguished by the rounded flat scales at the sides of the segments of the tail, which, indeed, appear rather to be but the lateral extensions of the segments

than lobes analogous to those of *Ph. Paguri*, *fusticaudatus*, &c. The body is rather broadly ovate, nearly symmetrical, the head being bent a little to the left; flat on its dorsal surface, its ventral side being concealed by large ovigerous scales, which do not extend over the sides of the body so as to conceal the legs, which are not very robust. The antennæ are very minute, and in the middle of the head, on the underside, is a small somewhat semicircular raised lobe. The segments of the tail are continuous with the hinder part of the body, the flattened lateral scales of the former rendering the joints nearly as wide as the latter, the pair of these scales attached to the terminal segment are directed backwards and are somewhat more pointed at their extremity. On the ventral surface of the tail are two rows of fleshy somewhat elongate cylindrico-conic appendages, obtuse at their extremities, and which when stretched out do not extend beyond the sides of the tail, and are consequently not visible from above.

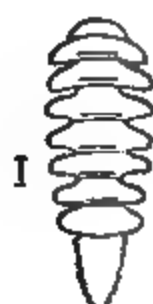
In addition to the specimens obtained from Hermit Crabs described above and in the following pages, we have received an exceedingly minute male, captured on a *Pagurus Bernhardus* on the coast of Durham, which we cannot satisfactorily assign to its legitimate partner. It is preserved in Canada balsam, and is of an elongate form, somewhat ovate in its general outline, with the sides of the segments of the body and tail regularly rounded, without any wide interval between them. The outer antennæ are sufficiently large to extend beyond the sides of the head; they are three-jointed and setigerous at the tip, and the inner antennæ are extremely minute and two-jointed; the mouth appears to consist of a conical tubercle in the middle of the lower surface of the

head. The legs are very robust, but folded so as not to extend beyond the sides of the body. The tail is composed of six joints, gradually diminishing in width, the last being very small, nearly oval, the tip pointed, and with a minute seta on each side beyond the middle.

Dr. Fritz Müller, in a letter to us dated in 1864, observes, that "One of the most interesting animals of this family is a Bopyrus living on Pagurus, in which the dorsal surface of the parasite is directed towards the Pagurus (I therefore named it *B. resupinatus*). The origin of this curious manner of attachment is the following:—The larva of Bopyrus fixes itself to the *Sacculina purpurea*, living on the same *Pagurus*, and takes its nourishment from the roots of the parasite. After the death of the *Sacculina*, to whose ventral surface the Bopyrus was fixed, the latter probably cannot change its position, and remains with its dorsal surface facing the Pagurus."

ISOPODA.
NORMALIA.

BOPYRIDÆ.



PHRYXUS LONGIBRANCHIATUS.

Male. Elongate, with the cephalon narrower than the pereion. The eyes very minute. The segments of the pereion nearly equal, laterally separated from each other by a considerable interval. Pleon composed of an elongate ovate-conic piece, in which the segments are fused together.

Female. Ovate, flattened, slightly unsymmetrical, curved a little to the left when viewed dorsally. Pleon with the six segments well defined, narrower than the pereion, furnished with a pair of elongate fleshy lobes on each side of each segment, and with four attached to the terminal segment.

Length of the male, one line; of the female, about one-fifth of an inch.

This species is at once distinguishable from *Phryxus Hippolyte* and *Ph. fusticaudatus* by the greater number of fleshy lobes at the sides and extremity of the tail of the female, as well as by their different formation, which latter character separates it from *Ph. Paguri*. The male has the segments of the body of nearly equal width through-

out, the sides dilated laterally, with the anterior lateral angles of each rounded off so that there is a considerable interval between the segments. The tail, on the contrary, has all the joints soldered into a solid piece. This sex is furnished with very short, smooth legs, terminated by a hand much larger than the preceding joints, with a rather strong curved movable finger.

The female is oblong-ovate, flattened, slightly curved towards the left, so as not to render it very unsymmetrical. The eyes are very minute, the sides of the segments impressed, with the legs inserted within the impressions; they are strong, with the intermediate joints as large as the hand, and rugose on their underside.

The tail is about half the length of the body, narrower than the terminal segments of the latter, each joint furnished at each side with a pair of elongate fleshy somewhat cylindrical lobes attenuated towards the tip, the terminal segment being furnished, as appears to us, with four of these lobes (one of the four being represented as attached to the left-hand pair of the fifth segment in the right-hand figure of the woodcut illustrating this species).

This species bears some resemblance to *Bopyrus foliosus* of Kröyer, Voy. Scandinave, Crust., pl. 29, fig. 2, but the rounder form of the pereion, the more elongated tail, and the different form and apparent number of the appendages of the tail, and especially those of the terminal segment, at once distinguish the last-named species from the one before us. Kröyer's specimens, indeed, appear to form a connecting link between *Phryxus* and *Athelges cladophora* of Hesse.

Our specimens of this species were forwarded to us from Shetland, by Mr. J. Gwyn Jeffreys.

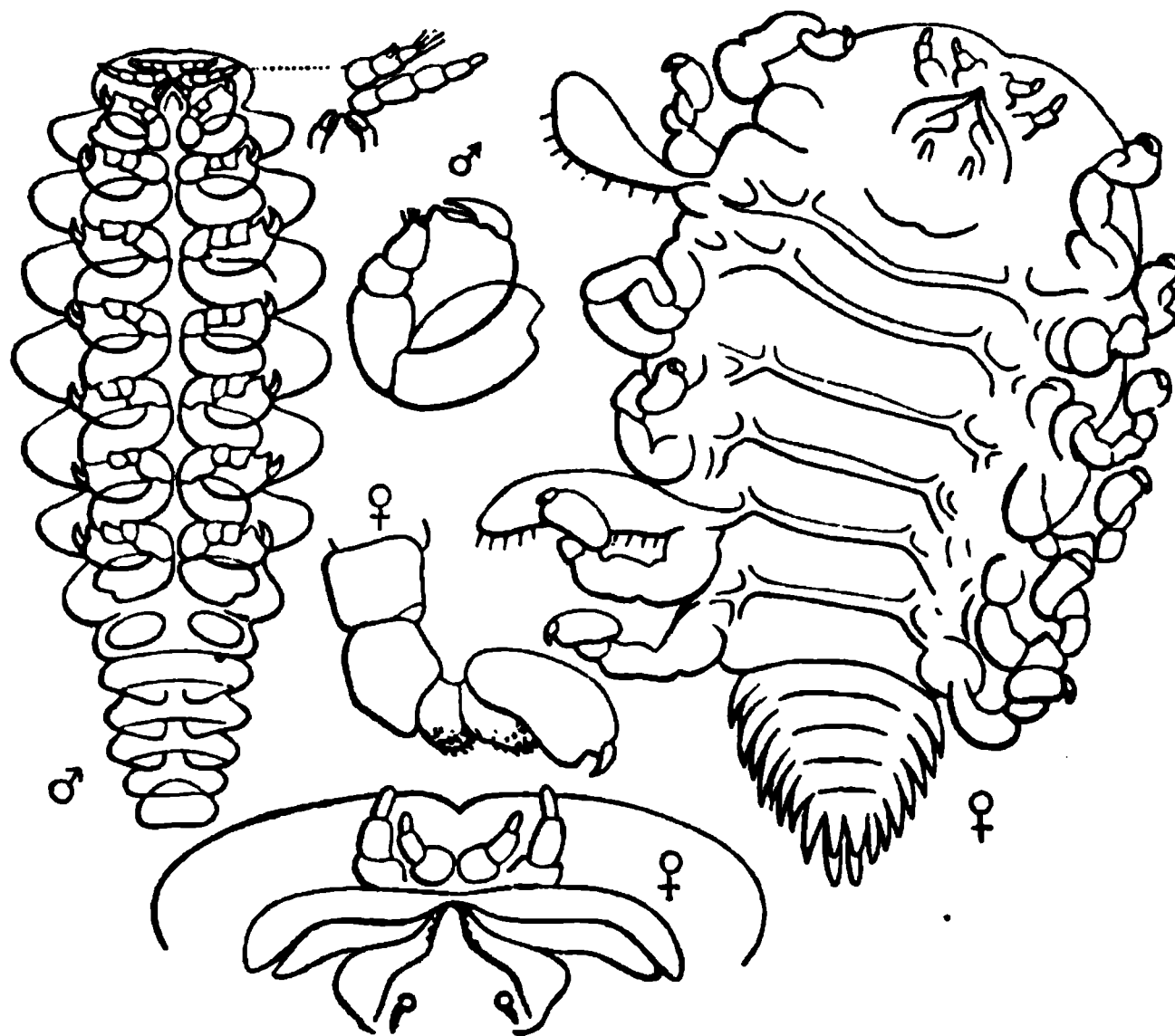
The Rev. A. M. Norman announces it from a specimen

of *Pagurus Thompsoni*, dredged off Tynemouth, Aug., 1862.

From Polperro we have received specimens of both sexes, captured by Mr. Loughrin, upon an old specimen of *Galathea squamifera*, of a much larger size than those represented above, the male being $\frac{4}{11}$ ths and the female $\frac{11}{12}$ ths of an inch long. They precisely agree in general form and in most of their details with the preceding. The feet of the male are, however, more powerfully constructed, with a semicircular emargination on the underside of the hand, but the dorsal appendages of the basal segments of the tail of the female are thicker and more rounded in form, whilst the lateral ones as well as the four attached to the terminal segment are more pointed at their extremities and corrugated along their surface. These differences do not appear to us to be incompatible with the enlarged size of the individuals, presuming that those described and figured above are not full grown.

ISOPODA.
NORMALIA.

BOPYRIDÆ.



PHRYXUS GALATHEÆ.

Male. Elongate; with the segments of the pereion rounded at the sides, especially towards the hind margin of each. Segments of the pleon distinct, transverse, rounded at the sides of each, narrower than the hinder segments of the pereion, terminal joint truncated at its extremity.

Female. Ovate, flattened, and slightly unsymmetrical, ovigerous scales of moderate size, finely ciliated on the margin. Pleon nearly triangular, joints transverse, furnished with a number of elongated corrugated fleshy cylindrical appendages, pointed at the tips.

Length of the male one-sixth, of the female one-fourth, of an inch.

Pleurocrypta Galatheæ. HESSE, Ann. Sci. Nat., 3rd ser. vol. iii. pl. 4.

THIS species nearly resembles *Ph. longibranchiatus* in the general form of the female and in the elongated lobes of the tail of the same sex. It differs, however, in its habitat, being parasitic upon *Galathea intermedia*, and in the distinct articulations of the tail of the male. Our specimens of the two sexes are, however, preserved in

Canada balsam, and it is not impossible that they have been somewhat distorted, and which also precludes our examining them satisfactorily.

The male (represented on the left hand of our woodcut of this species) has the segments of the body very distinct and rounded at their sides, the posterior lateral angles of each being rather more rounded off than the anterior angles; the six-segmented tail is narrower than the hinder segments of the body; its segments are, however, equally distinct and rounded at the sides, truncated at the hinder margin, the terminal segment being transverse, with the sides rounded, and the extremity truncated. The legs are strong and hooked; when folded in their ordinary position, they nearly cover the underside of the body. The first pair of antennæ are three-jointed and setigerous at the tip, whilst the second pair are five-jointed, the terminal joint being very minute. The small conical mouth appears to be protected on each side by a minute two-jointed footjaw.

The female is broadly-ovate, with the ovigerous scales rather narrow and fringed with a few minute setæ. Both pairs of antennæ consist of three small joints; they are minute, and somewhat conical in general form. The legs are longer, and comparatively not so strong as those of the male. The mouth is represented as it appears in our prepared specimen in the lower figure of our woodcut. The tail is nearly triangular in form; it is furnished at the sides and beneath with elongate-conic fleshy appendages, the precise number and distribution of which we are unfortunately unable to describe, but suppose that there are two pairs to each of the six segments.

Our specimens were obtained from Shetland in 1864, collected by the Rev. A. M. Norman.

ISOPODA.
NORMALIA.

BOPYRIDÆ.

Genus—IONE. (*Latreille.*)

THIS genus is at once distinguished from all the other *Bopyridæ*, except *Argeia* of Dana, by the possession of elongated branchial (?) appendages attached to the base of the six anterior pairs of legs in the female, and by the structure of the branchiæ affixed at the sides of the tail in both sexes; all of these in the male, and the posterior pair in the female, are elongated and filiform, whilst the pairs attached to the five anterior segments of the tail in the female are greatly elongated and multi-ramose, resembling pieces of coral.

The male is minute, resembling those of the *Bopyri*, with the head distinct, the outer antennæ prominently projecting beyond the front margin of the head, the inner pair rudimentary, the seven segments of the body of nearly equal size and width (except the first, which is shorter than the rest); they are separated from each other by a considerable space, having the lateral margins somewhat angularly produced, the legs being affixed beneath the lateral angles. The legs resemble those of the male *Bopyri*, and are terminated by a small oval hand, with a small curved finger. The tail is narrower than the hinder segments of the body, and consists of six distinct segments, gradually narrowing in size, each segment being furnished with a pair of elongated slender, cylindrical, membranous appendages (pleopoda).

The female is much larger than the male, with the body flattened, pear-shaped, and slightly unsymmetrical. The head is transverse in front, its posterior portion being

narrowed so as to resemble a shield, and embedded in the first segment of the body. Its anterior margin is dilated over the base of the antennæ, the extremities of which extend beyond it. The inner pair of antennæ are minute and rudimental; the outer pair are larger, and composed of five joints, gradually attenuated, and terminated by a small articulated flagellum. The mouth is covered by a pair of lamellated foot-jaws, somewhat resembling those of the genus *Cymothoa*, and the mandibles are arranged as in the same group; but, as described by M. Edwards, they are more slender towards the tip, and are destitute of any articulated appendage. The other parts of the mouth appear to be replaced by semi-membranous lobes, of which the precise structure has not yet been determined. The segments of the body are distinct, with the lateral margins sub-continuous, but destitute of epimeræ, thus disagreeing with the *Cymothoæ*. The legs resemble those of the male; each of the six anterior pairs are furnished beneath at the base with two appendages of considerable size, one being broad, foliaceous, of a semi-corneous consistence, and folded beneath the body so as to assist in forming a large ovigerous pouch, covering the whole of the underside of the body; the other being an elongated slender membranous filament, which lies on the outside of the body, floating in the water, and resembling the branchiæ attached to the legs of the *Amphipoda*. The tail is small and ovate, with the segments indistinct, except at the sides, where they are marked by slight incisions; the appendages attached to the five anterior segments are elongate, and branched like a piece of coral, whilst the posterior pair are slender, cylindrical, and simple. Several of the basal appendages are, moreover, furnished at the base beneath with a small scale, lying beneath the tail.

The species are parasites on some of the most curious genera of macrourous *Decapoda*, the British species infesting our only species of *Callianassa*.

The only specimen of this genus that we have had an opportunity of examining was found on a *Callianassa* taken by Mr. Lord in British Columbia. It was very much larger than our British species, and is described as *Ione cornutus* by Mr. Spence Bate in the "Proceedings of the Zoological Society" for 1864.

The large size of the animal enabled us to examine the detail of its structure with comparative ease. Laden as it was with mature larvæ, the large ovigerous plates covered the whole of the under surface except the pleon. We saw nothing of the delicate narrow membranous appendages attached to the legs that Professor M. Edwards supposes to be branchiæ, like those of the *Amphipoda*.

The organs of the mouth consist of several appendages much differentiated, and co-operating together so as to form one large oval mass, that was evidently endowed with some degree of propulsive movement.

The mandibles consist of a pair of long narrow plates that are serrated at the anterior edge, one being obliquely convex, the other concave: the one that is concave being convex nearer the base, while the reverse is the form of the other, so that the blades being each a little curved, the two meet at the point much in the form of a screw. These cutting appendages are planted at the extremity of the œsophagus, which, from its membranous character, probably has a contractile power.

The two pairs of maxillæ appear to be developed round the mandibles as a strong support and framework, the whole of which has the power of being pushed out or withdrawn by the assistance of powerful muscles that are attached to a strong osseous tendon

near the middle of each organ. On each side, near the posterior extremity, exist two digital processes, the secondary appendages of the maxilla. The maxilliped consists of three primary joints, the first two being large and squamous, the third small and rudimentary. Posterior to the point where this joint articulates with the preceding, lies the secondary appendage which, like those of the preceding pair, is digital in form, and points backwards.

The appendages of the pleon consist of three kinds, namely, a primary branch minutely articulated throughout its length; the basal articulus, which probably represents the coxa or first joint in the normal organ, supports two appendages, one large and saccular, being constricted at the base and pointed at the apex, the other long, narrow, symmetrical, and pointed. These two appendages are constant on every pair of pleopoda, but bear an inverse proportion to each other. In the anterior pair the saccular branch is the more important, but this gradually diminishes on each to the last pair, where it is almost, if not quite, obsolete, whereas in the first pair the digitiform process is the smaller of the two; this gradually increases on each succeeding pair of pleopoda, until in the last pair it forms the long pair of caudal processes seen so conspicuously at the extremity, and to which in this present species the male was attached by means of the subprehensile claw of the posterior pair of pereopoda. To all the segments, except the last, are attached one or more of the numerous arborescent branches of which the mass of branchiæ is built up.

The male offers only specific variation from that of our British species.

ISOPODA.
NORMALIA

BOPYRIDÆ.

IONE THORACICA.

Male.—Narrow, subparallel, first segment of the body shorter than the following, the remainder with the sides subangulated.

Female.—Pyriform, flattened, basal appendages of the tail multi-ramose.

Length of female, about one-quarter of an inch.

- Oniscus thoracicus*. MONTAGU, Trans. Linn. Soc. ix. p. 103, pl. 5, f. 3.
Oniscus (Ione) thoracicus. LATREILLE, Enc. Méth. pl. 336, fig. 46.
Ione thoracicus. LATREILLE, in Règne An. Ed. i. iii. p. 54. LAMARCK, Hist. Anim. sans Vertèbres, v. p. 170. DESMAREST, Cons. Crust. p. 286, t. 46, f. 10. GUÉRIN MÉNÉVILLE, Icon. R. Anim. Crust. t. 62, f. 1, 2. MILNE EDWARDS, Crust. iii. p. 280, t. 33, f. 14, 15. CUVIER, Règne Anim. (Edit. Crochard) Crust. t. 59, f. 1. WHITE, B. M. Cat. Brit. Crust. p. 81. Pop. Hist. Brit. Crust. p. 254, pl. xiv. f. 8a. (male), b (female).

It is to Colonel Montagu that we are indebted for the first knowledge of this interesting parasite, which inhabits the branchial cavity of *Callinassa subterranea*, concealing

itself between the branchial appendages and the carapace, and forming a tumour on one side. From this situation he extracted it alive, and kept it in sea-water for several days. In all the specimens which he discovered the female was attended by the minute male, which was concealed amongst the arborescent appendages of the tail, to which it was affixed firmly by its claws. He adds, that the very disproportionate size of the sexes is wisely adapted to an animal whose habitation is so confined.

As we are only acquainted with a single British species (which is also found on the north-west shores of France), it is unnecessary to redescribe the characters of the species, which are included in those of the genus given above. The colour of the animal is generally orange, with the appendages whitish. Our figures are copied from the beautiful ones published by M. Milne Edwards in the Crochard Edition of Cuvier's "Règne Animal," that author having been enabled to examine recent specimens of both sexes. It was found by Colonel Montagu in the Kingsbridge estuary, on the south coast of Devonshire.

The *Callianassa* on which it lives exists in galleries of its own excavation, about a foot beneath the surface of the sea bottom.

Unfortunately, the specimen preserved in the British Museum, and to which is attached a label in Montagu's hand-writing, is not an *Ione*, but a *Bopyrus*.

Brebisson ("Crust. Departm. Calvados") states that *Ione thoracicus* "se trouve sous les pierres baignées par la mer;" but we fear that he was misled by Latreille's incorrect reference of *Oniscus caruleatus* (*Praniza*) to the *Oniscus thoracicus* of "Montagus," in the "Encyclopédie Méthodique." We cannot reconcile his description of the animal with the true *Ione*.

ISOPODA.

BOPYRIDÆ.

NORMALIA.

Genus—CRYPTOTHIRIA.

- Cryptothir.* DANA (1852).
Liriope. RATHKE (1843, not *Liriope* of Lesson.—G. Medusæ, 1839.)
Liriopsis. SCHULTZE, Wieg. Arch. 1859, p. 310.
Cryptoniscus. FRITZ MÜLLER MSS.
Hemioniscus. BUCHHOLZ.

THE animals of this genus differ from those of most of the genera of *Bopyridæ* in the nature of their habitats (being parasitic on crustaceans that are lower than themselves in the natural classification) as well as in their structure; the supposed males, or at least the young, bearing a much stronger resemblance to the young than to the full-grown male *Bopyri*, whilst the females appear to be entirely destitute of antennæ, legs, branchial lobes, or other appendages.

The supposed males and young are very minute, oval or elongate in form, convex, with the head and segments of the body and tail distinct, the former semicircular, provided with two eyes and four antennæ, of which the anterior pair are very minute and slender, whilst the posterior pair are greatly elongated, being about half the entire length of the animal, composed of three or four moderately long basal joints, followed by a multi-articulate flagellum, of which the first articulus is the largest. The parts of the mouth have not been determined, but they appear to be covered by a large square pair of plates (maxillipeds), of which the lower margin is serrated, or possibly only fringed with hairs. Each of the

seven segments of the body is furnished with a pair of legs, affixed within the lateral margin on the underside; they are more elongated than in the *Bopyri*, and more or less hooked for prehension; they are nearly uniform in size, the anterior pair being, however, the strongest, and the posterior the longest and most slender in one or more of the species.*

Each of the segments of the tail is furnished on the underside with a pair of branchial appendages differing in form in the different species, but very strongly fringed with long setæ.

The female is a large inert mass of animal matter, destitute of appendages, and is affixed to the animal on which it is parasitic. It is divided into two portions, the one consisting, according to Lilljeborg, of four distinct segments, which supports the organ or tube by which it adheres to its prey, whilst the hind part of the body consists of a simple sac for holding the eggs.

Writing to us on this genus, Dr. Fritz Müller says, "Changes in form not less important than those observed in the *Hyperina* are to be seen also in the *Bopyridæ*. I have already published the description of a new genus of this family, *Entoniscus*, whose retrograde metamorphosis proceeds much farther than that of *Bopyrus* (see p. 265 *post*, note †). I have since found another species of the same genus living in different Brachyura (Xantho, &c.), and a second genus (*Cryptoniscus*, F. Müller, MSS.), almost unrecognizable when adult; indeed the female of it then resembles *Planaria lactea* rather than an *Isopod*. It is, moreover, very interesting in its habits; it does not take its sustenance directly from the little Pagurus, on whom it is fixed, but from the roots of the

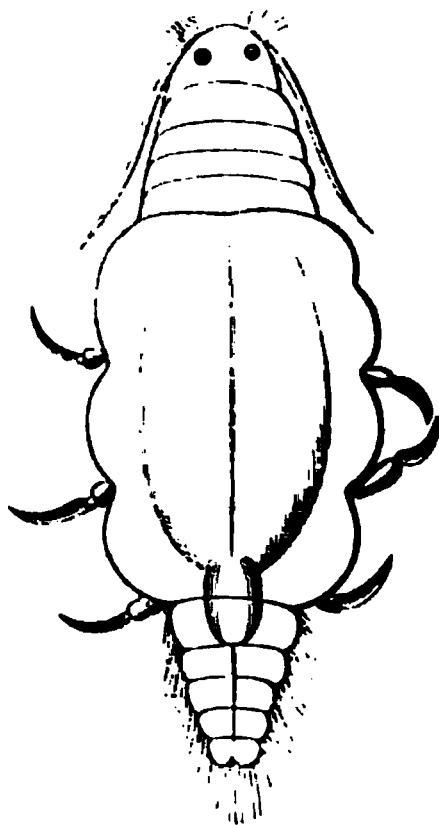
* In the species observed by Lilljeborg and Fritz Müller (*Entoniscus Galatheæ*) the young have only six pairs of legs.

Sacculina purpurea, which it kills, but whose roots, notwithstanding, continue to grow and frequently attain an extraordinary development.

“ In the genuine Bopyridæ all the feet are of the same form, while in *Entoniscus* and *Cryptoniscus* the sixth (or last) pair show a very different structure.” The larva of *Cryptoniscus* has the sixth pair of pereiopoda long, slender, and styliform. That of *Entoniscus* has the same limbs long and slender, with large and powerful prehensile claws.

M. Hesse, in his Fourth Memoir on Rare or New Crustacea of the coasts of France, “ Ann. des Sci. Nat. 1864, ser. v. vol. ii. p. 281,” described and figured the female of *Peltogaster tau*, which he found on *Paguri*, together with its monoculoid-cirriped-like embryo. More recently (in his Tenth Memoir, *Ibid.* vol. vi. p. 321, 1866) he gives an elaborate account of *P. paguri*, in which he describes an animal, of which he had only taken a single specimen on a *Pagurus*, and which he considers, without sufficient proof, as the male, together with the female, and the young animal in its earliest stage of development. The earliest form of the larva he describes as resembling that of the *Entomostracous* crustacea, and states that, as in all of the suctorial crustaceans, the larva has three pairs of appendages. He also describes it as having lateral processes on each side of the anterior margin of the head, and that these processes are immature antennæ, thus proving its relationship with the Cirripedes, and leading us to infer that the parent animal which he figures as the female is bisexual, and that his supposed male has no connection with the female, but must be considered as that of a Bopyroid crustacean, possibly of a Cryptothiria in an advanced stage of

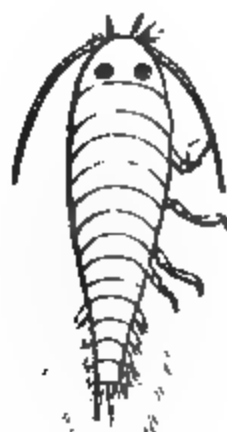
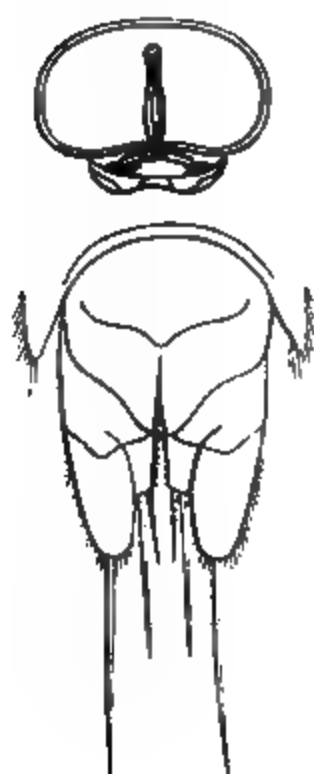
development. Lilljeborg, Rathke, and Buchholz, on the contrary, describe and figure the larva of the present genus as we find it to exist among the Bopyroid crustacea generally, and which is a modification of the typical Isopod.



INTERMEDIATE PRANIZA-LIKE FORM OF THE FEMALE OF *C. BALANI*, FROM BUCHHOLZ.—(See p. 271.)

ISOPODA.
NORMALIA.

BOPYRIDÆ.



CRYPTOTHIRIA PYGMÆA.*

Specific character. — *Supposed Male.* — Elongate-ovate, posteriorly attenuated, convex above, concave beneath. Cephalon rather longer than the following segment. Anterior pair of pereopoda strongest; posterior pair of pereopoda long and slender. Sixth or terminal segment of the tail forming a minute plate, covering the base of the hind pleopoda.

Female with the body divided into two portions, the anterior composed of the head and three following segments, connected by means of a constriction

* The woodcut at the head of this article represents the male of *C. pygmæa*, and the extremity of its body highly magnified, from specimens furnished by the Rev. A. M. Norman. The female *C. pygmæa* (copied from Lilljeborg) is the upper left-hand figure; Rathke's figure of the young *C. pygmæa* (which, if the form of the antennæ be correct, is undoubtedly a male of mature form) is copied in the upper right-hand figure; whilst the lower right-hand figure is copied from Lilljeborg's figure representing the side view of the young of *L. pygmæa*.

or neck with the hind part or matrix, which is exarticulate or sacciform, kidney-shaped, destitute of appendages.

Length of male, one-tenth of inch ; female, (?)

Liriope pygmæa.

H. RATHKE, Reise Bemerk. aus Skand. in Neust. Schr. Naturf. Ges. Danzig, tom. 2, p. 105—110 (1841). Nova Acta Acad. Cæs. Leop. Nat. Curios. tom. 20, p. 244, pl. 1, figs. 8—12. LILLJEBORG, Liriope et Peltogaster, in Nova Acta Reg. Soc. Upsal. ser. 3, vol. iii. p. 6, pl. 1, figs. 1—23 (1859). Suppl. to ditto in ditto, pl. 6, figs. 1, 2 (1860).

Oniscus squilliformis.

PALLAS, Spec. Zool. fasc. 9, p. 50 ! CAVOLINI, Memoria sulla Generaz. dei Pesci e dei Granchi, transl. Erzeugung der Fische u.d. Krebse, pp. 164, 165, pl. 2, figs. 18 m, n, r, r.

THE history of this species has been remarkable, nor can it yet be regarded as free from difficulties. Cavolini, as quoted above, first described and figured two different crustaceous animals (one of which he doubtingly referred to the *Oniscus squilliformis* of Pallas) which he had found parasitic within a sac attached to the tail of a crab belonging to the genus *Portunus* or *Carcinus*. In 1839, Rathke found in the Norwegian Sea, upon the bodies of *Carcinus mænas* and *Pagurus Bernhardus*, two species of vermiform parasites, which he regarded as belonging to the *Entozoaria* (but which have since been proved, by their transformations, to belong to the *Cirrhipeda*), and which have subsequently been described under the names of *Pachybdella Carcini** and *Peltogaster Paguri*.

Within the body of the latter of these two parasites Rathke found eight minute crustaceans, which he considered had been devoured by the *Peltogaster*, and which he described under the name of *Liriope pygmæa*, referring them to the order *Amphipoda*, unaware that the generic

* Professor Bell, in his volume on the Stalk-eyed Crustacea, p. 108, describes the female of this parasite (*Pachybdella carcini*) as infesting *Portunus marmoreus* even to a greater extent than *Carcinus mænas*.

name had been employed four years previously for a genus of *Medusæ*, by Lesson.

Steenstrup, in the "Oversigt" of the Royal Danish Society for 1854 (pp. 145—148), considered that this minute *Liriope*, instead of having been devoured by the *Peltogaster*, was either a parasite upon it, or that it was its young state. Professor Schmidt having, however, shown that the young of the *Peltogaster* resembled that of the *Cirripedes*, Steenstrup (subsequently, op. cit. p. 214) abandoned his former opinion, leaving the question unsettled.

In the "United States Exploring Expedition," Crust. p. 801, pl. 53 (1852), Dana described a new genus (which he unnaturally placed in the family *Tanaidæ*), under the name of *Cryptothir*, remarking, as Steenstrup had done, that Rathke's *Liriope* was not an Amphipod, but in reality an Isopod crustacean. Steenstrup had, however, referred *Liriope* to the family *Balanidæ*. Three or four specimens of the *Cryptothir minutum* were taken separately in as many individuals of the corallidomous barnacle, *Creusia*.

In 1858 Lilljeborg found in the Norwegian Sea a *Pagurus pubescens* with a *Peltogaster* attached to its tail; but the parasite appeared to be double, one portion being filled with eggs, and which he consequently considered to be the single ovigerous sac of the parasite hanging suspended from the body, as is the case with the double egg-sac of the *Cyclops*, &c. But the fact that the *Peltogaster* was a suctional animal, and not a mandibilated one (like the *Cyclops*), and that the egg-sac had motions independent of the *Peltogaster*, even after the latter had died, and the body of the *Pagurus* had putrefied, greatly perplexed Lilljeborg. He then examined the sac and its contents more carefully, and discovered that the former was a distinct animal, *parasitic upon the parasite*, and that the

young were totally unlike the Cirriped-formed larvæ of the *Pellogaster*, and that they exactly resembled Rathke's *Liriope*; thus proving that the body of the supposed *Pellogaster* of Rathke, in which the *Liriopes* were found, was, in fact, the superposed body of the second parasite, or, in other words, that the female of *Liriope* was now discovered, that Rathke's animals were the young of that female, that Dana's *Cryptothir*, found upon a *Balanus*, was either the young or male of a closely-allied animal, and that Cavolini's parasite, found upon *Portunus*, was to be referred to the same group. As the minute and active *Liriopes* were found, both by Rathke and Lilljeborg, within the egg-sac of the parasitic female, the question arises (and is still undetermined) whether these little creatures are exclusively young males, or are the larvæ-form of both sexes? and whether the adult male does or does not retain its larva shape almost unaltered during the whole of its life? Analogy with the stages of development of the *Bopyridæ*, and especially with those of the following species, would lead us to adopt the opinion that in their earliest stages both sexes of this genus are alike in form, and that whilst the female gradually loses the articulated character, together with all the external appendages of the body, the male retains much of its larva condition. Such is the opinion of Lilljeborg, who has argued the question at considerable length, and such appears probable on taking into consideration the comparative characters of the young and adult males of *Bopyrus squillarum* (as represented in our figures in p. 218), of *Gyge galatheæ* (p. 225), and of *Ione thoracica* (p. 254), and those exhibited in our several figures of the young or males of this species, given by Rathke and Lilljeborg copied as above, and our own as given in the cut at the head of this article. According to Lilljeborg, however,

the youngest state of the animal has only six pairs of legs, the sixth being half as long again as the others, and terminated by a very slender elongated finger, whilst the five preceding pairs are of equal size, and subcheliferous.* Rathke, on the contrary, although he only figures four of the legs on one side of the body of his *Liriope* (the fourth being minute and slender), expressly states, in the description of his figures, that his detached figure of this hindmost leg represents the *seventh*, or posterior one. As it is impossible, however, to overlook the strong relationship which evidently exists between the *Liriope* and *Entoniscus Porcellana*,† elaborately de-

* Lilljeborg's statement seems fully confirmed by Fritz Müller's description of the larva of *Entoniscus Porcellana*.

† The female of this remarkable parasite resides within the body of a species of *Porcellana*, lying in a thin-walled sac between the liver, intestine, and heart of its host, the head being "destitute of eyes and antennæ; the thorax has become an irregular inarticulate sac, beset with enormous brood-laminæ; the long vermiform and extremely mobile abdomen has sword-shaped legs; and swelling out above it in a globular form, as if in a hernial sac, the heart lies at the base of its first segment!" The young of this singular parasite closely resembles that of *Bopyrus* and *Liriope*, being oblong-ovate and flattened in form, with one pair of antennæ very short and thick, whilst the other pair is half the length of the body, and bent backwards. "The five anterior segments of the thorax bear similar feet, terminated by a thickened ovate palm, and a slightly curved powerful claw." The sixth pair of legs are only three-jointed, the last joint being elliptical. There is no seventh pair of legs. "The abdomen bears, first of all, four pairs of natatory feet, with a crescentiform basal joint, and a lancet-shaped terminal joint, furnished with strong bristles." The fifth abdominal pair of legs is a narrow and short appendage, without bristles, cleft into two unequal divisions; and the terminal pair of appendages consist of a thick basal joint and two slender biarticulate terminal branches.

The male somewhat resembles that of the *Bopyridæ*. The body is elongate-obovate and regularly articulated, the head is trapezoid, with rounded angles extending considerably beyond the sides of the following segment. The only pair of antennæ are short, inarticulate, flat, and quadrangular. The mouth forms a "triangular rostrum." "The six anterior thoracic segments bear feet reduced to nearly sessile inarticulate roundish lumps. The seventh segment has no feet, but bears on each side, at the posterior margin, a wart-like process, and on this the genital orifice." The abdomen is considerably elongated and narrow, composed of six segments entirely destitute of appendages.

scribed by Fritz Müller (Archiv. f. Naturg. xxviii. p. 10, and Ann. Nat. Hist. 3 ser. x. p. 87, pl. 2), we are led to the conclusion that the animal we figure from our own drawing is a young male of this genus, and that in its full-grown state it may be somewhat modified in the form of its locomotive organs.

The female of *C. pygmæa* is now, however, satisfactorily known by the researches and figures of Lilljeborg. It consists of two separate portions in its adult ovigerous state, the anterior being convex and smooth on the upper side, and concave beneath, composed of four segments, of which the two central ones are the largest; the first, or head properly so called, constituting an organ by which the animal affixes itself upon the *Peltoaster*. The hind part of the body is exarticulated, sac-like, kidney-shaped, and convex above, with a slit on its underside through which the young are expelled. There is not the slightest vestige of antennæ, eyes, mouth-organs, prehensile or branchial legs.

Our specimen of the supposed male was taken with the dredge off Guernsey by the Rev. A. M. Norman, not attached to any animal, but he found it in a bottle in which crustacea, for the most part Amphipods, had been put.

ISOPODA.
NORMALIA.

BOPYRIDÆ.

CRYPTOTHIRIA BALANI.

Specific character.—*Immature (?) Male.*—Elongate-ovate, cephalon furnished beneath with two flat lobes, serrated on their posterior margins, mouth forming a conical process; upper antennae very short, lower antennae nearly half the length of the animal, reflexed; pereion with seven pairs of pereopoda, first and second pairs with strong palms and hooked fingers, five posterior pairs slender and simple. Pleon with five pairs of branchial appendages, each composed of two lobes.

Adult Female.—Forming a large inert seven-lobed mass, destitute of exerted antennae, jaws, legs, or branchial appendages.

Length of the supposed male, about one line; female, about one-quarter of an inch.

Liriope balani.

SPENCER BATH, Brit. Assoc. Report, 1860, p. 225.

Hemioniscus balani.

BUCHHOLZ, in Siebold and Kolliker, Zeitschr. f. Wissensch. Zool. xvi. 3 h. p. 303 (September, 1866).

Balanus balanoides, male.

GOODALL, H. S., on the Sexes of the Cirripeda, &c., Edin. New Phil. Journal, p. 88, v. 35 (1843). Ann. d. Sci. Nat. 3 ser. Zool. t. 1. pl. 15 c.

THE first notice we possess of this animal is that given

by Mr. Henry Goodsir in the "Edinburgh New Philosophical Journal for 1843," where he erroneously described the female, or the animal represented in our right-hand figure, as the male of the cirriped (*Balanus balanoides*), and the animal, copied in our left-hand figure, as being parasitic upon that supposed male.

About the time of the publication of a memoir in the "Annals of Natural History," "On the Development of the Cirripeds," in 1851, our attention was drawn to a fleshy mass of material that we found attached to the base of the animal of the *Balanus balanoides*, lying within the shell. This we first took to be the ovisac of the *Balanus*, because we found it always full of ova, which we then thought were the ova of the *Balanus* in one particular stage. In this we thought we were confirmed by the fact that we never found the ova of *Balanus* in the condition most familiar to us in any of those specimens where these ova were found. A drawing of the mass, which

DEVELOPMENT OF LARVA OF CRYPTOETHIRIA BALANI.

we submitted to Mr. Darwin, induced him to suggest it as being the parasite that Mr. Goodsir described as the male of the cirriped; and an examination of the article "On the Sexes of the Cirripeds," clearly showed us that

Mr. Goodsir's figures were more or less perfect representations of the mass that we had observed.

The young, which we have frequently taken in an incomplete stage, are developed as in true Isopoda; and the earliest larval condition, as figured by Goodsir and Rathke, shows that the animal is, both in its development and parasitic habit, closely allied to the Bopyroid crustacea.

The animal represented in the middle of our wood-cut, which we consider to be the male, corresponds, so far as the head and anterior segments of the body are concerned, with that which Mr. Goodsir has figured as being the anterior segments of his supposed male, and, if Mr. Goodsir's dissections be true, appears to offer a very considerable evidence of the near relation of the two animals. But we were inclined to think that Mr. Goodsir's figures, 1—3 in pl. 3, which he gives as the concealed cephalic portion of what he calls the male of the *Balanus*, and the entire dorsal view of the same animal given in pl. 4, fig. 10, were taken, the former from the real male, and the latter from the female, *Liriope*.*

Though frequently having taken the females in connection with the *Balanus*, and these also charged with ova in various stages, we have never taken the male associated with the female, as is almost invariably the case with the other genera of the *Bopyridæ*. In this species

* In the elaborate memoir of Dr. Buchholz above referred to, published last September, the learned author has arrived at an opposite conclusion relative to the true condition of our supposed male, which he has carefully figured and described as the larva-form of the species, and which, in certain individuals at least, becomes developed into the female, the fully developed condition of the male being still unknown. This observation completely supports the correctness of Goodsir's statement, that his figures 1-3 represent the anterior articulated part of the animal of which a dorsal view is given in his figure 10, in which, however, the articulated portion is concealed by the swollen front of the second division of the body.

we have always found that which we consider as the male animal to be free, and roaming distantly from its supposed mate. The cirriped which it infests (*Balanus balanoides*) is a gregarious species, and lives upon the rocky shore between the tidal marks, and we have frequently seen, on breaking off a mass of the *Balani*, the little red crustacea run away, and the paucity of the males that we observed in comparison with that of the females, has induced us to consider that the male wanders about from one cirriped to another. The animal is of a red-brown colour, and is an active little creature.

The female, in its adult state, is a large inert inarticulate mass, destitute of antennæ, mandibles, or foot-jaws, legs or branchial appendages, with the body dilated on each side into three large rounded or conical lobes, the tail itself forming a terminal lobe similar to the others. In Dr. Buchholz's specimen the body (probably from having been immersed in spirits) was of a broader and rounder form than in our figure, with the lobes more conical and more regularly radiating, giving the animal more of a star-like appearance. It is furnished with a short mouth or sucker, by which it affixes itself to its prey.

The young animal, as described by Buchholz, or the male as suggested above, is elongate (more ovate in Buchholz's figure than in our own), with the head as wide as the following segment, which, as well as the remaining segments of the body (and also of the tail, according to Buchholz), have the lateral margin deflexed, with its posterior margin serrated. The mouth consists of a conical process, protected above by two flattened plates, of which the posterior margin is serrated. The minute pair of upper antennæ are affixed at the sides of these appendages, and consist of a strong basal joint, thickly fringed with long setæ, and a terminal articulated

flagellum. The lower antennæ are strong and elongated, consisting of four large basal joints, gradually diminishing in length and thickness, and terminated by an articulated flagellum. The seven segments of the body are furnished with the same number of legs, of which the first and second pairs are shorter and more robust than the rest, and terminated by an oval palm and a movable finger.* The remaining five pairs of legs are long and slender, the seventh or last pair especially being longer than the rest. The tail is obconical, the five anterior segments being furnished on the underside with as many pairs of branchial appendages, each consisting of an oblong basal piece, bearing two terminal branches, of which the inner is long and conical, and the outer shorter and pointed. Buchholz, on the contrary, represents them as consisting of a dilated basal subtriangular joint, terminated by two oval or suboval plates, strongly fringed at the posterior margin with long setæ.



The transformations which this minute active pedigerous animal undergoes in assuming the adult female form have been carefully observed and figured by Dr. Buchholz. In the earliest of these changes we observe a striking analogy with the form of the female *Anceus*, the three posterior segments of the body coalescing, losing their articulated character, and swelling out into a large mass, in which the segments are only indicated by lateral impressions; those of the tail, however, remaining distinct.† In the following stage the tail is entirely absorbed, forming a terminal exarticulate conical mass, continuous with the lobes of the body, but with the

* In our specimen we could not determine the precise form of the first pair of legs, and which are not quite correctly given in our figure.

† See Vignette in page 260.

head and four anterior segments and legs of the body still distinct. In the next stage the great terminal mass, forming seven rounded lobes, is much increased in size, the fourth segment of the body has become absorbed,* and a large membranous dilatation also appears on the underside of the general mass. In the final stage all distinct traces of the head and three anterior segments appear to be lost, and the animal reduced to the inert mass represented in the right-hand figure of the wood-cut at the head of this article. According to Buchholz, however, the full-grown female still retains the antennæ and fore pair of legs, although immersed in the fore portion of the sac-like envelope of the rest of the body (see his fig. 4 in pl. xvii. "Vorderkörper eines erwachsenen individuum von dem Sacke abgetrennt"). It is from this circumstance, as well as from a consideration of the character and number of the legs and branchial appendages of the immature state that Dr. Buchholz was led to separate this animal from *Liriope* as described by Lilljeborg, under the name of *Hemioniscus*. Until, however, the males of both species are positively determined, we consider it more advisable to retain them both in one genus.

* The animal in this state exhibits a striking analogy to the adult gravid female of the Chigoe (*Pulex penetrans*).

THE second subtribe of the Parasitical Normal group of the Isopoda contains all those species in which the sexes are not materially unlike each other, the males being generally nearly as large as, or larger than, the females, with the dermal tissue hard and crustaceous, the pereiopoda well developed, the oral organs formed for mastication, the mandibles being horny, having the terminal half narrowed and curved inwardly, with the apex formed for gnawing, the base also furnished with a triarticulate appendage. The pleon is terminated by a large flat crustaceous plate representing the sixth segment, bearing near its base at each side a pair of elongate flattened lobes (uropoda) arising from a dilated base.

These animals compose the family of Cymothoadiens of Milne Edwards,* which he has divided into three tribes corresponding with our families—namely, 1. CYMOTHADIENS RAVISSEURS or SEROLIDÆ; 2. C. ERRANS or ÆGIDÆ; and 3. C. PARASITES or CYMOTHOIDÆ.

The first of these tribes consists of the singular genus *Serolis*, the species of which are thought by many to offer a very strong resemblance to the *Trilobites*. They are all natives of the Ocean surrounding South America, and are distinguished by their flat circular form with moderately long antennæ, and with the first or the first and second pairs of legs strong and cheliferous, whilst the remainder are slender and fitted for walking.

The second tribe corresponds with our family ÆGIDÆ,

* The Cymothoadæ of Dr. Leach's article in the "Dictionnaire des Sciences naturelles" was still more extensive, as he introduced into it not only the groups admitted by M. Milne Edwards, but also our *Sphæromidæ* and the genus *Limnoria*.

whilst the third tribe, *C. parasites*, forms our restricted family CYMOTHOIDÆ, the species of which are parasitic on fishes, all their legs being alike in form and strongly hooked for prehension, they are all, as well as the antennæ, short, and the latter are always inserted on the underside of the head, beneath a prolongation of the forehead, and the body is of a less firm consistence than in the *Ægidæ*, thus approaching the *Bopyridæ*. The species are numerous, but chiefly inhabitants of Tropical Seas ; some few are, however, known to inhabit more temperate climes, but no specimen has hitherto been satisfactorily determined as having been found in our own seas, although *Cymothoa Cæstrum** is introduced by

* *Cymothoa*, Fabricius, is distinguished from the other genera of this tribe or family by having all the segments of the pleon distinct and movable, the pleon itself considerably narrower than the terminal portion of the pereion, the last segment wider than long, and the legs tolerably strong and subcheliferous.

*Cymothoa Cæstrum*¹ is distinguished from the other species of the genus by having the anterior margin of the cephalon advanced and bent down between the inner antennæ, which are inserted widely apart, the first segment of the body very large and advanced beyond the head on each side, and by the lower edge of the bases of the fourth pair of legs armed with a strong tooth.

This species is found in the Atlantic Ocean and in the Seas of both Indies. It attacks fish, and makes occasionally large wounds sufficient to cause the death of the individuals attacked.

¹ *Oniscus Cæstrum*, LINN. Syst. Nat. pp. 1059, no. 2, Faun. Suec. no. 2053. Mus. Adolph. Frid. 89. FABRICIUS, Syst. Ent. p. 294. Sp. Ins. i. p. 375, no. 4. PALLAS, Spic. Zool., fasc. 9, p. 74, tab. 4, fig. 13, A. B.

Cymothoa Cæstrum. LEACH, Edinburgh Enc. vii. pp. 405 and 433. Enc. Brit. Suppl. 1, p. 428. Trans. Linn. Soc. xi. p. 372. Dict. Sc. Nat. t. 12, p. 353. SAMOUELLE, Ent. Compend. p. 109. DESMAREST, Cons. Crust. 309, pl. 47, figs. 6, 7. MILNE EDWARDS, Hist. N. Crust. 3, 269. Règne An. (Crochard Edit.), Crust. pl. 65, f. 1.

Asellus Cæstrum.

OLIVIER, Enc. Méth. 4, 253.

Samouelle into his work on British Insects, without, however, any locality being subjoined, and, as it is omitted by Mr. White in his Catalogues of the British Crustacea, it seems evident that no tradition exists in the British Museum (of which Mr. Samouelle was also an officer) to warrant its introduction. As it is possible, however, that it or some other of these fish-parasites may occur, we have introduced the above family characters.

In the second tribe of Milne Edwards, forming our

Fam.—ÆGIDÆ,

The species are amongst the largest known Isopods, and are distinguished by having their antennæ fixed in front of the head, the basal joint of the anterior pair being very broad and flat, and uniting together to form a margin in front of the head, not being concealed beneath the advanced cephalon; the outer-foot jaws have the basal joints moderately dilated, with three or four terminal joints, which are rarely palpiform; the pereiopoda are of moderate length, the anterior pair being generally the strongest and fitted for prehension, being terminated by a robust curved finger, acute at the tip; whilst the hind legs are gradually elongated and fitted for walking. The five segments of the pleon are very short, each on its underside supporting a pair of double foliaceous plates for respiration, whilst the last segment of the pleon is large and flat, and bears on each side near the base a pair of flat appendages, scales arising from a basal joint, of which the inner angle is sometimes produced into a long style.

ISOPODA.
NORMALIA.

ÆGIDÆ.

Genus—ÆGA. (*Leach*).

Generic character. The three anterior pairs of legs in this genus are strong and terminated by a powerful hook-like finger, whilst the four posterior pairs are longer and more slender, with a but slightly curved terminal finger, so as to fit them for progression; the short inner antennæ have the basal joints very broad and flattened, occupying the front margin of the head.

THE species of this genus are of large size. They are oval, moderately convex, with most of the segments marked transversely with a slight ridge. The coxæ or first joint of the legs (epimeral pieces of Milne Edwards) are formed so as to appear as part of the dorsal surface. The eyes are of large size and oval, extending considerably backwards at the sides.

The outer antennæ are affixed beneath the fore margin of the head, and are separated from each other by an elevated scutcheon-like piece or labrum; they are composed of five or six strong basal joints gradually increasing in length, but diminishing in thickness, and are terminated by a flagellum composed of about a dozen articulations.

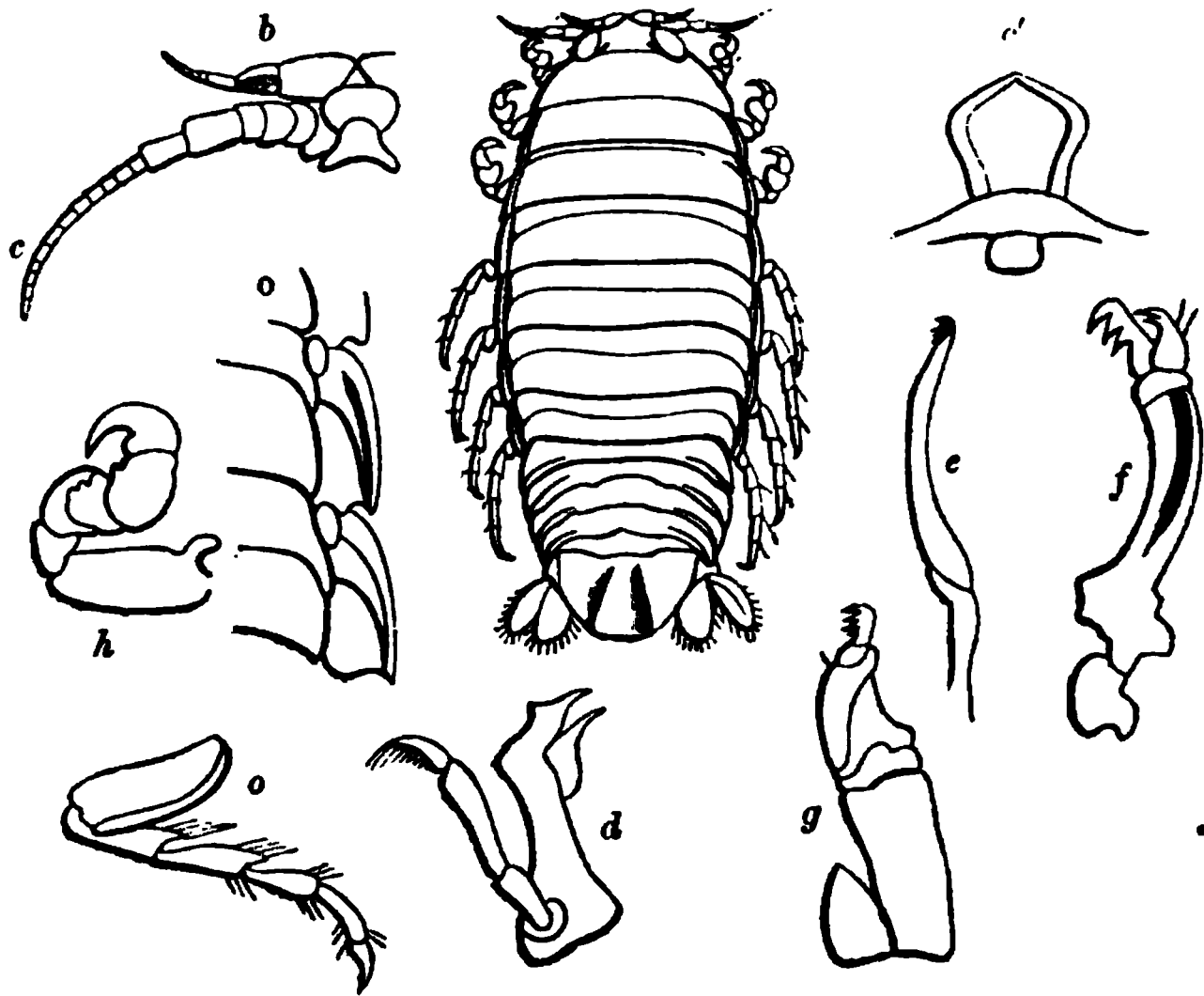
The mandibles are strong, with the apical portion angulated and bifid; they are furnished with a prominent three-jointed palpiform appendage arising near the external base. The outer-foot jaws are rather valve-shaped, with the basal joint strong and elongated, bearing a triangular

lobe on its external base; the second joint is produced internally, and the three terminal joints are short, the last being armed with several minute teeth; the outer pair of maxillæ are curved and slender, terminated by two denticulated pieces, and the inner pair of maxillæ are still more slender, with several minute reflexed teeth at the tip.* The pleon is nearly as wide at the base as the terminal segment of the pereion; the four anterior segments are of equal size and short, with the lateral margins strongly produced posteriorly into an acute angle; the fifth segment is shorter than either of the preceding, whilst the terminal segment is large, flat, conical, or semiovate or semicircular, often with one or two central ridges; each of the five basal segments bears on its underside two pairs of delicate membranous ciliated branchial plates, all of nearly equal size, and each pair arising from a transverse basal piece. They do not cover the whole of the underside of the tail. The terminal segment also carries on each side a pair of flattened appendages that do not reach beyond the posterior extremity of the pleon.

* Our description of the parts of the mouth is made from *Æga bicarinata*. In Milne Edwards's figures of details taken from *Æga emarginata*, the different organs appear to be less denticulated at the tips.

ISOPODA.
NORMALIA.

ÆGIDÆ.



ÆGA BICARINATA.

Specific character. Animal depressed, terminal segment of the pleon wide at its extremity, bearing on its upper side two diverging carinated lines, which terminate at the posterior angles, the intervening space nearly straight or slightly emarginate. Uropoda with the inner division larger than the outer, truncated at the inner extremity.

Length, $1\frac{1}{2}$ inch.

Æga bicarinata. LEACH, Dictionn. Sci. Nat. xii. p. 349. DESMAREST, Cons. Crust. p. 305. MILNE EDWARDS, Crust. iii. p. 241. CUVIER, Règne An. (Edit. Crochard), Crust. t. 67, f. 2. BATHKE, in Nov. Acta Cæs. Leop. Nat. Curios. vol. xx. pl. 6, f. 1—12. WHITE, B. M. Cat. Brit. Crust. p. 79. Pop. Hist. Brit. Crust. p. 251, pl. xiv. f. 5. GOSSE, Man. Mar. Zool. 1, fig. 232.

THIS is one of the largest species of known Isopods, some individuals measuring about one inch and a half in length. It is at once distinguished by the two elevated divergent lines on the terminal segment of the tail and by

the larger size of the inner division of the appendages at the sides of that part of the body, which is, moreover, somewhat truncated at its inner extremity, whilst its outer margin has a slight emargination near its extremity. The eyes are wide apart and occupy the posterior angles of the head.

The upper antennæ are scarcely longer than half the width of the head; the basal joint is large, flat, and square, the second joint produced along its anterior margin so as partially to conceal the base of the third joint (when seen from beneath), which is slender and succeeded by a very short flagellum, consisting of five or six articuli; the lower antennæ are about as long as the width of the head, and have three short thick basal joints; the fourth is longer than the third, and the fifth nearly as long as the fourth, but more slender, and is followed by a flagellum, consisting of twelve articuli; these organs are separated at the base by a scutellum-shaped labrum, arising from a transverse keel or epistome. At the sides of each segment of the pereion the coxæ of the legs are developed as parts of the dorsal surface (epimera), and have their outer portion raised and curved so as to form elevated spines overlapping each other; the segments themselves are marked across the middle, or nearer the base, with a raised line; the four anterior segments of the pereion are of equal size. The surface of the pereion is seen, under a strong magnifying power, to be entirely covered with very minute circular punctures, amongst which larger and more irregularly shaped ones are disposed without order.

Our drawing is made from Dr. Leach's original type specimen in the British Museum, to which his own manuscript name is still attached. In this specimen the extremity of the tail is formed precisely as represented

in our figure. Dr. Leach, however, in his description, says, "extrémité presque tronquée, *échancrée*."

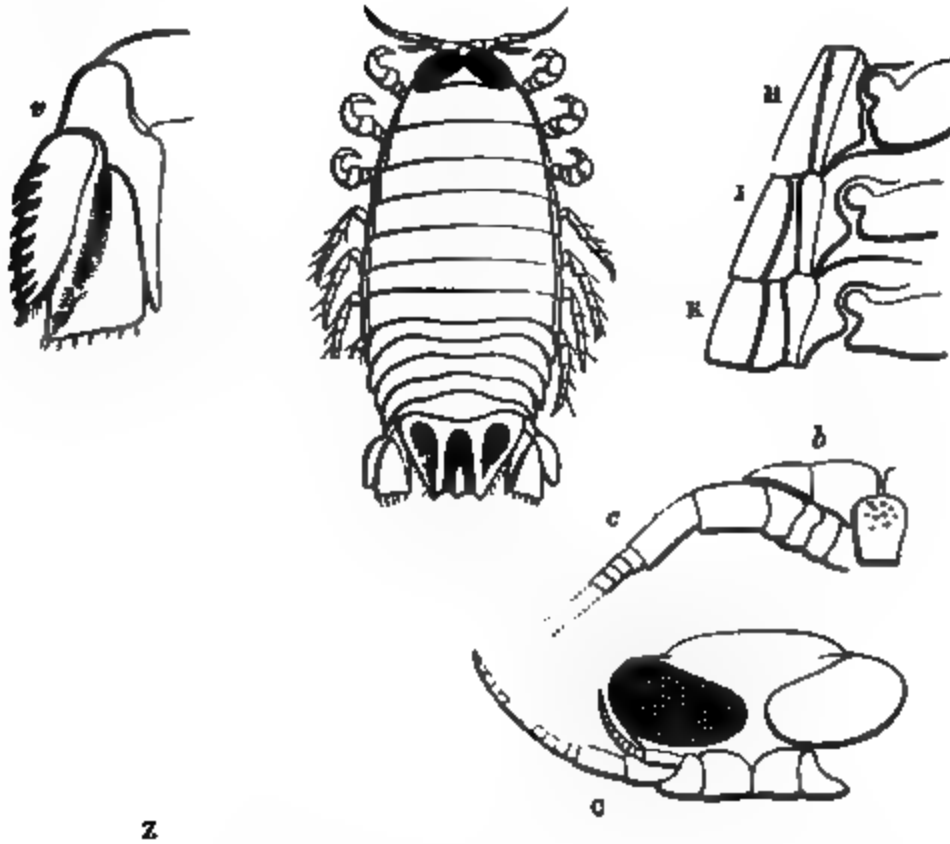
The species inhabits the Mediterranean, and is also found not unfrequently on our coasts.

Specimens from St. Leonards are in the Hopeian collection at Oxford. We have also obtained it by trawling in Plymouth Harbour at the beginning of February, and have received it from the Rev. A. M. Norman, who has taken it on the coast of Durham.

The Oxford Museum also possesses a small specimen labelled as having been taken at Plymouth, which was considered by Mr. Hope as a distinct species (the MS. name of "Spilota, Hope," in the handwriting of the donor himself, being attached to it), it being dotted all over with small brown spots, arranged at equal distances apart, so that there are about a dozen occurring next the posterior margin of each segment.

ISOPODA.
NORMALIA.

ÆGIDÆ.



z

ÆGA TRIDENS.

Specific character. Differs from *Æga bicarinata* in having the last segment of the tail furnished with three carinae, each of which is produced into a small point beyond the posterior margin of the segment, the space between the two lateral teeth being emarginate; eyes large, having only a small space between them in the centre of the anterior margin; inner plate of the caudal appendages larger than the outer and truncated at its extremity.

Length, an inch and a half.

Æga tridens. LEACH, Trans. Linn. Soc. xi. p. 370. Dic. Sc. Nat. xii. p. 349. DESMAREST, Crust. p. 305. MILNE EDWARDS, Crust. iii. p. 242. WHITE, B. M. Cat. Brit. Crust. p. 80. Pop. Hist. Brit. Crust. p. 251.

Var. ? with central spine of tail obsolete. *Æga monophthalma* var. minor. JONESTON, in London's Mag. Nat. Hist. vii. p. 233, fig. C. (!)

THIS species is closely allied to *Æga bicarinata*, but is distinguished by the three carinae on the terminal segment of the tail, the two lateral ones being the strongest, and each terminating in a small tooth on the posterior edge of

the tail, which is emarginate. The body is elongate-ovate, and convex, the eyes large and nearly meeting on the crown; the upper pair of antennæ are not longer than the head, with a flagellum composed of about twelve articulations, the two basal joints very broad (the second obliquely emarginate), with the flagellum affixed on its hinder angle. The coxæ of the legs attached to the anterior segments of the pereion are subquadrate and marked with straight elevated ridges; these are represented in our upper right-hand figure as seen on the underside of the body, showing the base of the three fore legs on the left side.

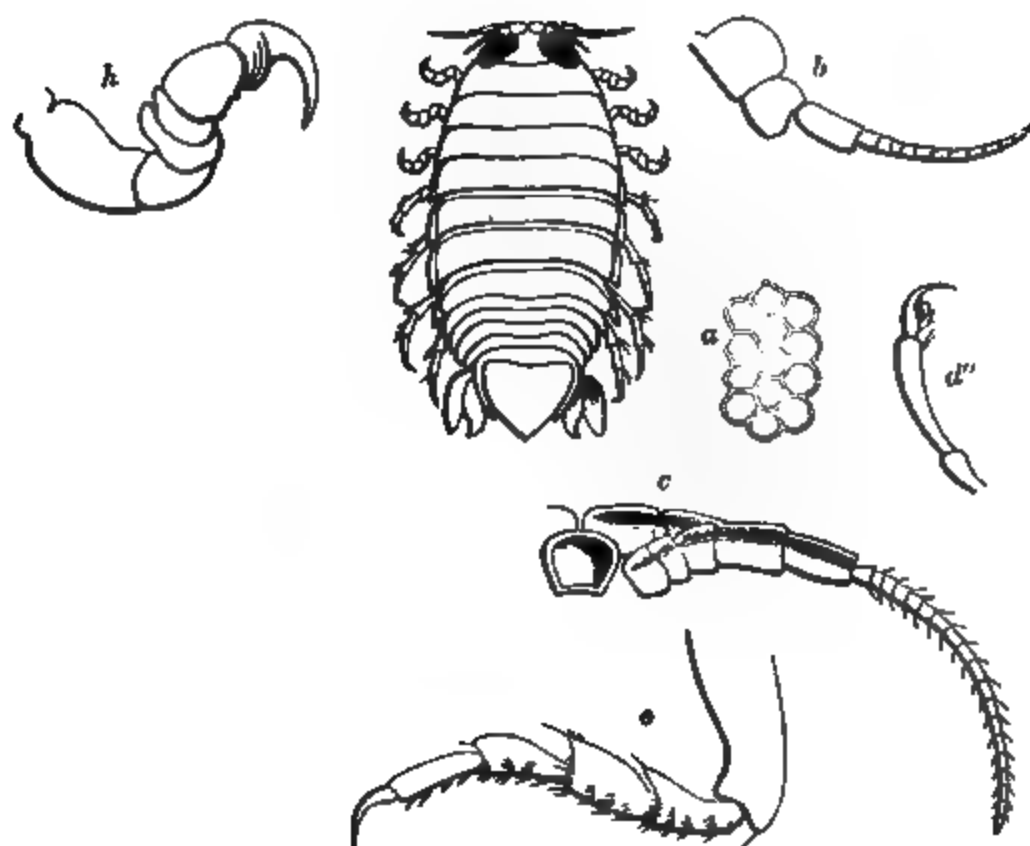
The branchial plates on the underside of the body (as represented in our lower left-hand figure) scarcely extend beyond the middle of the terminal segment; they are all of nearly equal size, the upper or outer pair not covering the whole or even the following pair. The lateral appendages also, when folded up, scarcely extend beyond the lateral margins of the terminal segment, the truncated extremity of each inner division uniting and leaving a triangular space uncovered at the extremity of the tail; the outer division of these lateral appendages is considerably smaller than the inner, and elongate-ovate in form, pointed at the tip, with the outer edge armed with spines arranged in transverse rows.

The typical specimen of this species described by Leach was contained in Sowerby's collection from Scotland, and Mr. Gregor has sent it to us from the Moray Frith, and there are others now in the British Museum from Belfast, presented by Colonel Portlock.

The late Mr. W. Thompson, of Belfast, also obtained it from Belfast Market, where it was found among Carrickfergus oysters, at the end of March, 1839, and also from a cod-fish brought to the same market in February, 1841.

ISOPODA.
NORMALIA.

ÆGIDÆA.



ÆGA PSORA.

Specific character. Oval and convex, coxæ marked with two oblique lines; those attached to the four anterior segments square, those to the three posterior segments subtriangular and distant from each other; terminal segment of the pleon triangular, smooth on its upper side, with the lateral margin slightly dilated; inner plate of the lateral appendages emarginate near the extremity of its outer edge.

Length, $1\frac{1}{4}$ to nearly 2 inches.

Oniscus psora. PENNANT, Brit. Zool. vol. iv., pl. 18, f. 1, 1777 (certe).

Æga emarginata. LEACH, Dictionn. Sci. Nat. xii. p. 349. TRAN. Linn. Soc. xi. p. 370. Suppl. Enc. Brit. 1, 428, pl. 22. SAMOUELLE, Ent. Compend. p. 109. DESMAREST, Crust. p. 305, pl. 47, f. 4, 5. MILNE EDWARDS, Crust. iii., p. 240. CUVIER, Règne An. (Ed. Crochard), Crust. pl. 67, f. 1.

THIS species is distinguished at once by the somewhat triangular form of the terminal segment of the tail, which

is flat on its upper surface and destitute of the carinæ observable in the other British species; its sides are rather dilated at the base and somewhat recurved. The animal is oval and convex; the eyes large and lateral, with many hexagonal facets; those, however, of the external margin have their outer edge circular (a peculiarity now ascertained to occur in the hexagonal structure of the hive bee, which has lately been the cause of considerable discussion among Entomologists). In our figure, *a*, the third or right-hand row of facets is the external one. The upper antennæ are short, with a ten-jointed flagellum, whilst the lower ones have the same part formed of about eighteen articulations. The palpiform appendage of the mandible is very slender and terminated by a short thin and curved hook-like joint. The three anterior pairs of legs are strong and terminated by powerful hooked fingers; the middle joints in the first pair are very short, but in the third pair the second and third joints are armed with small conical tubercles; the four posterior pairs of legs are longer and more slender, the under edge of the terminal joints being spinose, the spines being set in transverse rows. The lateral appendages of the tail are narrow and of nearly equal size, the inner plate of each pair being strongly emarginate on its outer margin near the extremity, which is ciliated. In one sex these organs are accompanied on the inner edge by an elongated conical horny plate, represented in our middle left-hand figure.*

Although the species was introduced by Samouelle into his work on British species (no locality, however,

* In our principal figure of this species the articulation at the base of this narrow plate has been accidentally omitted, giving to the fifth segment of the tail the appearance of being produced on each side of the terminal joint into a long narrow point.

being given), it is omitted by Mr. A. White from his Catalogue of British Crustacea. Dr. Leach (the chief authority for Samouelle's work), indeed, stated in his description of the species "*localité inconnue*" (a specimen has, however, since been received by the British Museum from Iceland, from Mr. Drewsen), so that, except for the unnecessary doubt expressed by Leach in his reference to Pennant's *Oniscus psora*,* there is no recorded authority for its insertion in the British list. We are enabled, however, to introduce it unquestionably on the faith of a fine specimen in the Bell collection (now at Oxford, obtained at Scarborough by Mr. Bean, by whom it was presented, with other interesting species from that locality, to Professor Bell). This specimen has supplied the figures at the head of this description. The Hope collection also possesses a specimen from Nova Scotia, and we have received it recently from Mr. Gregor, who dredged it in the Moray Frith.

* Although unquestionably this is the *On. psora* of Pennant, it is doubtful whether it be identical with the species so named by previous authors.

ISOPODA.

NORMALIA.

ÆGIDÆ.

ÆGA MONOPHTHALMA.

Specific character. Oval, convex, eyes very large, uniting dorsally, extending obliquely backwards, the anterior margin of the first segment of the pereion being deeply incised on each side for their reception, terminal segment of the pleon flat, nearly semicircular, with a central carina terminating in a point.

Length, $2\frac{1}{2}$ inches.

Æga monophthalma. JOHNSTON, in London's Mag. Nat. Hist. vii. p. 233, f. 43.

Rocinela monophthalma. MILNE EDWARDS, Crust. iii. p. 244. WHITE, B. M. Cat. Brit. Crust. p. 80. Pop. Hist. Brit. Crust. p. 252, pl. xiv. f. 7. GOSSE, Man. Mar. Zool. 1, fig. 233.

THE animal is oval, of a pale brown colour, approaching to fleshy red, and when alive tinged with purple, dotted all over with numerous punctures. The upper antennæ are very short, the two basal joints much dilated, forming together a broad movable plate; the flagellum is setaceous, the lower antennæ more than twice the length of the superior, the three basal joints short and unequal, the flagellum multiarticulate. The head is almost entirely occupied by the large oblong eyes, which

coalesce dorsally and centrally; they are reticulated and extend obliquely backwards, leaving a small point projecting anteriorly between the base of the upper antennæ and a small central triangular space behind. The inferior antennæ are separated at the base by a small oblong concave plate or labrum. The seven segments of the body are nearly equal in size, marked with a faint line across the middle; their sides are furnished with strong coxæ pointed posteriorly, and with two slight ridges down the middle. The first three pairs of legs are directed forwards; they are robust, and furnished with strong curved claw-like fingers; the four posterior pairs of legs are longer and much more slender, with the joints nearly equal and spinose, terminated by curved fingers. The tail is formed of six segments, of which the five first are short and equal, and the terminal one broad, oblong, roughish, depressed, with a strong keel down the centre ending in a short mucro; the margins of these segments are minutely spinose; on each side of the terminal segment is a pair of foliaceous plates articulated to a movable, acutely pointed, somewhat triangular process; the inner plate is wedge-shaped and the outer one oblong; both are densely ciliated round the edge.

Dr. Johnston, whose detailed description is slightly abridged above, adds that this species swims with rapidity by the aid of its "caudal fins," and when it comes in contact with a solid body it clasps against it and adheres tenaciously. His specimens were taken adhering to large cod-fish, of which it is probable they are the "pedicular parasites;" but, unlike some of their race, they appear to be very rare, at least in Berwick Bay, as he could only procure three individuals, and the fishermen had never observed them before.

Dr. Johnston also described and figured as a variety of

the other sex a smaller specimen ($1\frac{1}{4}$ inch long), having the two basal joints of the upper antennæ not disproportionably enlarged, and the last large segment of the tail emarginate-truncate, with a shallow furrow down the centre, and two obtuse raised keels at its sides. In other respects no difference appeared to exist. Except that the eyes in the figure of this smaller individual are represented as being of the same size as in the larger ones (uniting in the centre of the forehead), we should have referred it to Dr. Leach's *Æga bicarinata*, or more probably to *Æ. tridens*, with the central tooth of the tail plate worn away (the eyes being large, as in that species). Dr. Johnston, however, regarded it as belonging to the same species as the larger individuals, and probably the male of it, considering the dilatation of the basal joints of the upper antennæ as a sexual character, or one dependent on age (and of insufficient value, therefore, to be ranked among the characters which are seized upon to divide tribes and families from each other), and also that the conformation of the terminal segment of the tail is not sufficient to discriminate species, as Dr. Leach seems to have believed, "for his specific characters embrace no other part," at least in the species of *Æga*. Unfortunately the comparative rarity of these parasites does not yet allow us to determine this point.

The individual of this species described by our late friend Dr. George Johnston was taken in Berwick Bay on a cod-fish, and is preserved in the British Museum, which also contains another specimen from the Northumberland coast, presented by Mr. R. House.

There are also British specimens of unnoticed locality in the Hopeian collection; and we have received them from Shetland, from the Rev. A. M. Norman, who also records it from the Moray Frith.

ISOPODA.
NORMALIA.

ÆGIDÆ.

Genus—ROCINELA. (*Leach.*)

Generic character. Eyes very large and convex, converging anteriorly and nearly uniting in the middle of the forehead, which is produced into a conical point concealing the base of the upper antennæ; first and second joints of the latter cylindrical and much more slender than those of the lower antennæ, which are nearly one-third of the length of the body.

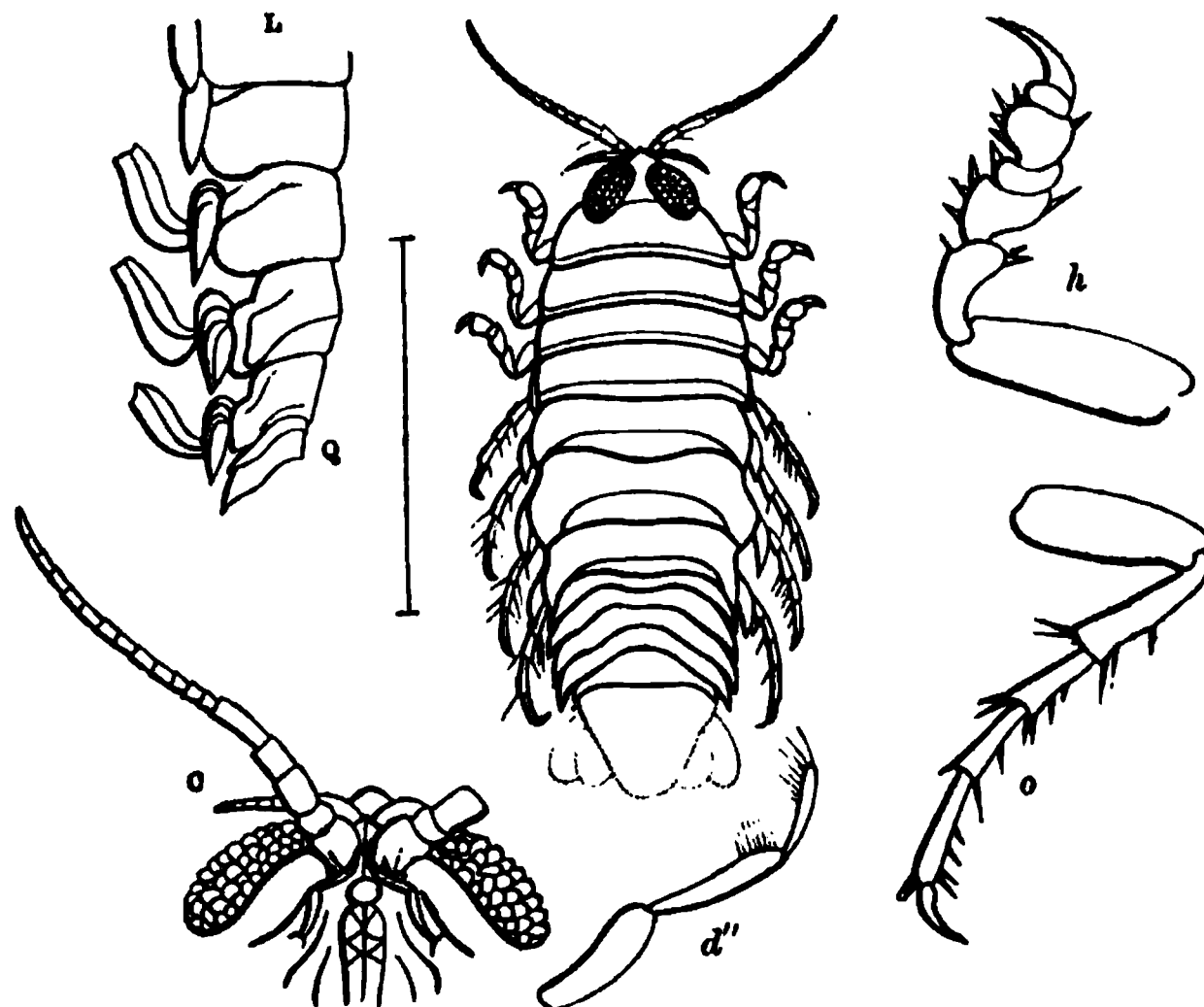
As our generic and specific descriptions are made from Dr. Leach's original type of *R. Danmoniensis* (the only species which he inserted in the genus), we are able to ascertain that M. Milne Edwards has misconceived Leach's views (which is not indeed surprising, as the very short and unsatisfactory descriptions given by the latter would scarcely afford a definite idea of its characters). We consequently find that the genus thus named in M. Milne Edwards's great work consists of species of *Æga*, with the eyes confluent and the basal joints of the upper antennæ rather more slender than in the typical *Ægæ*; but when we take into consideration, that the front of the head in Leach's type is produced into an obtuse conical point projecting *over* the base of the upper antennæ, which are much more slender than the base of the lower antennæ, the latter being also more than one-fourth of the length of the entire animal; that the pleon is as wide as the pereiion, the anterior segment being, however, very short, and abbreviated at the sides, which nevertheless terminate in an acute point; and that the three fol-

lowing joints of the pleon are large and broad, the posterior lateral angles being produced into a curved and acute point,—we shall be convinced that *Rocinela Danmoniensis* is the type of a distinct genus, and that *Æga monophthalma* of Johnston, which M. Milne Edwards, followed by Mr. A. White, introduces into the genus *Rocinela* on account of the large size of the eyes, ought to be referred to the genus *Æga*. This opinion is confirmed by the descriptions of the mouth-organs given by M. Milne Edwards in the Crochard edition of the “Règne Animal” of the species which he terms *Rocinela ophthalmica* (giving erroneously Leach as the author of the species), which prove that that species is in fact an *Æga*, differing only from *Æga emarginata* in the apparent soldering together of the two terminal joints of the foot-jaws.

ISOPODA.

ÆGIDÆ.

NORMALIA.



ROCINELA DANMONIENSIS.

Specific character. Elongate-ovate; eyes converging anteriorly, large, nearly joining dorsally; basal joints of the upper antennæ subcylindrical; coxa (especially of the three posterior pairs of pereopoda) prominent, elongate-ovate, and pointed; second, third, and fourth segments of the pleon sickle-shaped and laterally produced.

Length, one inch.

Rocinela Danmoniensis. LEACH, Dict. Sci. Nat. xii. p. 349. DESMAREST, Crust. p. 304. MILNE EDWARDS, Crust. iii. p. 244. WHITE, Cat. Brit. Crust. p. 80. Pop. Hist. Brit. Crust. p. 352.

THIS species has hitherto been known only by Dr. Leach's original typical specimen taken half a century ago in Plymouth Sound, preserved in the British Museum, which has supplied the materials for the figures given at the head of this description. It was described by Leach as being "en si mauvais état qu'il est impossible d'en

faire une description spécifique." The posterior segment of the tail is in fact destroyed, but the remainder of the body sufficiently proves its complete distinction from any other known British species. It is more elongate in form than the species of *Æga*, and the two basal joints of the upper antennæ are thin and subcylindric, inserted beneath the conically anteriorly produced middle of the anterior margin of the head (the flagellum is destroyed).

The lower antennæ are nearly one-third of the length of the body, with a stout flagellum, consisting of about thirteen articulations. They are inserted close together, and not separated by a ridge or scutcheon-shaped piece. The eyes are of large size, converging above and nearly uniting in front; each eye consists of nine rows of facets, the middle or longest row containing thirteen lenses. The palpiform appendage of the mandibles is slender and three-jointed, the second joint thickened at the tip and furnished with ten setæ set on at right angles; the terminal joint is about two-thirds of the length of the middle one, and terminated by a strong bristle, and about seventeen short setæ on its inner edge. The lateral margins of the segments of the body (especially the three posterior) are prominent and distinct, each being produced behind into a sharp point (our upper left-hand figure L to Q represents the four posterior segments of the body and the two anterior ones of the tail seen laterally). The terminal segments are traversed with a slightly elevated carina; the legs are rather longer than in the species of *Æga*; the three anterior pairs are strong, with the hand and wrist armed with a few short strong spines, and the finger unguiculated, having the base dilated so as almost to resemble a separate joint. The tail is as wide as the body; the anterior segment is narrower than the following, and very short, the sides ending in acute spines;

the three following segments are much larger and wider, with the sides ending in acute recurved processes; the fifth segment is as long as the preceding, but abbreviated at each side, and the sixth is obtusely triangular.

We have received it from Polperro, where it was taken by Mr. Loughrin, and there are specimens in the British Museum from Ireland that have the caudal termination more pointed than in our figure.

ISOPODA.
NORMALIA.

ÆGIDÆ.

Genus—CIROLANA. (*Leach.*)

Generic character. Pereiopoda formed for progression, each terminated by a slender nearly straight dactylos; lower antennæ long; superior short, cylindrical; pleon formed of six distinct segments; eyes small, granulated; head with submarginal channels.

THE animal is elongated and cylindrical-ovate; the head is semicircular (owing to the deep emargination of the following segment), with a minute triangle interposed between the base of the upper antennæ; it is also marked with an impressed line on each side near the outer orbit of the eyes, and another finely impressed line runs closely parallel with the anterior margin. The eyes are small, but strongly granulated. The upper antennæ are scarcely more than half the length of the head, the two basal joints broad and rather flat, the flagellum small, conical, and with about ten articulations; the upper antennæ are inserted *beneath* the latter; the two basal joints are short; the third, fourth, and fifth more elongated, and the flagellum is long and slender, composed of more than thirty articuli, extending as far as the third or fourth segment of the body; this lower pair of antennæ are separated at the base by a narrow elevated ridge, arising from a small triangular piece which rests upon the front margin of the transverse emarginate labrum.

Careful figures of the mouth-organs of *C. hirtipes* are given by M. Milne Edwards in the Crochard edition of the "Règne Animal."

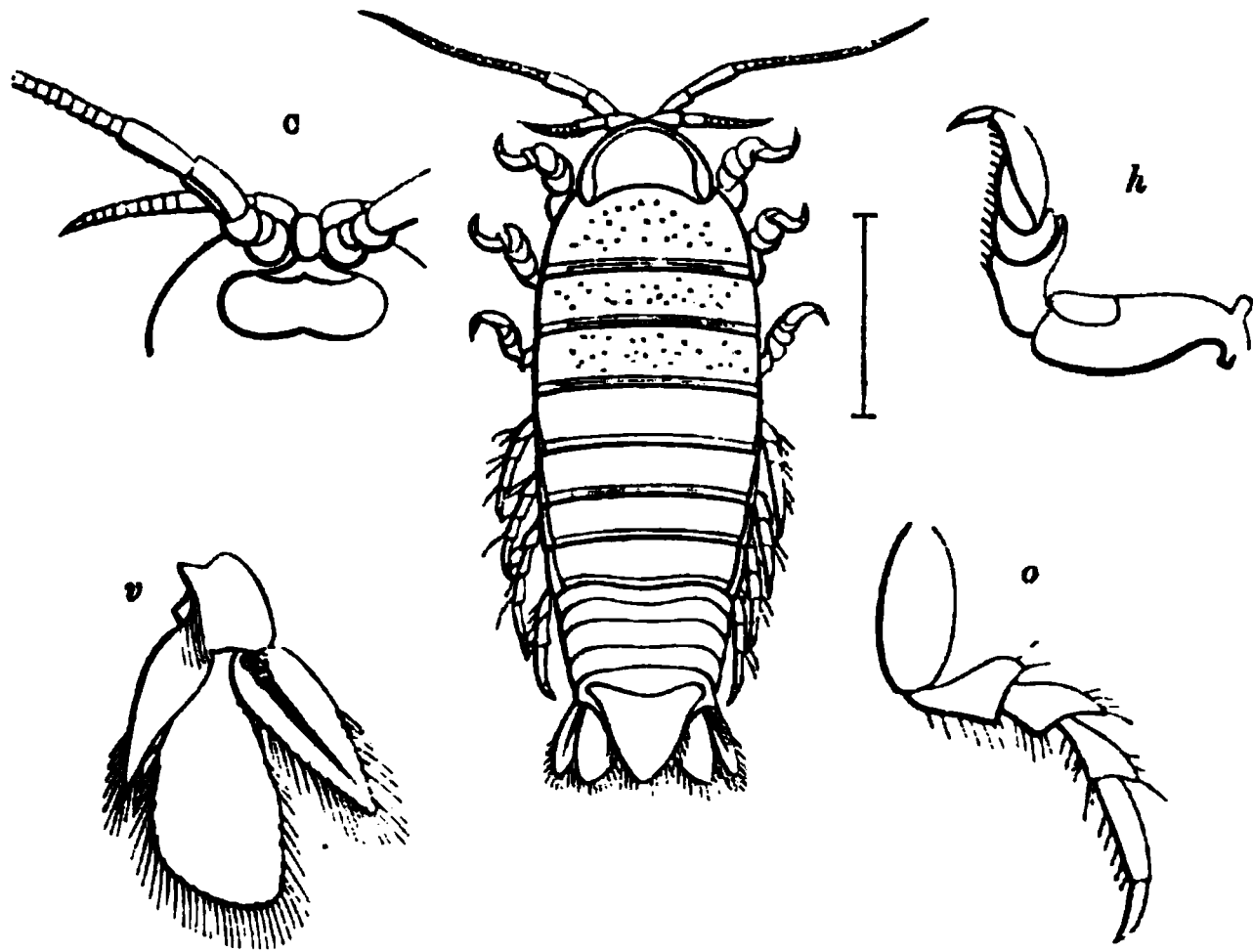
The mandibles are strong, angulated beyond the

middle, with several powerful acute teeth and an inner movable lobe; the palpiform appendage is long, three-jointed, and bent over the base of the lower antennæ.

The pair of foot-jaws are moderately strong, composed of six nearly equal-sized joints, deeply ciliated along the inner edge; the first pair of maxillæ are triangular, with the extremity narrowed, bearing an inner lobe of the same length as the extremity of the organ. The second pair of maxillæ are larger, stronger, and exarticulate, with the extremity curved and acute, furnished near the base of the inner margin with a small movable quadrate lobe, the inner margin itself armed with strong bristles. The tail is not quite so broad as the body, with the four basal segments of equal size, transverse, the fifth as long as the preceding, but abbreviated on each side, with the posterior margin straight, and not arched as in the preceding segments. The last segment of the tail forms a large triangular smooth plate, on the outer anterior sides of which are affixed the lateral appendages, of which the inner plate is the larger: they do not extend beyond the extremity of the terminal segment.

ISOPODA.
NORMALIA.

ÆGIDÆ.



CIROLANA CRANCHII.

Specific character. Animal subcylindrico-ovate, smooth, finely punctured ; segments with a slender pale line on the posterior margin, terminal segment of the pleon triangular, slightly rounded at the extremity, inner plate of the posterior appendages of the pleon larger than the outer, rather obliquely truncate, legs slightly spined.

Length, three-fifths of an inch.

Cirolana Cranchii. LEACH, Dictionn. Sci. Nat. xii. p. 347. DESMAREST, Cons. Crust. p. 303. MILNE EDWARDS, Crust. iii. p. 236. WHITE, B. M. Cat. Brit. Crust. p. 79. Pop. Hist. Brit. Crust. p. 249, pl. xiv. f. 3. GOSSE, Man. Mar. Zool. i. fig. 230.

THE preservation of Dr. Leach's typical specimen of this species, having the name *Cranchii* still attached to it in his small and very neat hand-writing, enables us to clear up the short and unsatisfactory descriptions of it given by M. Milne Edwards and A. White. The former

confines his specific description to four lines, given as a quotation from Leach : " Corps lisse ponctué ; le dernier article de l'abdomen triangulaire, arrondi à son extrémité, *lame externe des dernières fausses pates plus grande et plus large que l'interne ; cette dernière tronquée à son extrémité.*"* Leach's description is, however, confined to the pereion and last joint of the pleon, and M. Milne Edwards appears to have intercalated the latter portion of his characters from Leach's general observations on the third race of the Cymothoadæ (comprising the genera *Eurydice*, *Nelocira*, and *Cirolana*) : " dans ces trois genres la petite lame ventrale postérieure externe est plus grande et plus large que l'intérieure." In *Eurydice*, however, as well as in the only species of *Cirolana* described by Leach, the *inner* plate is considerably the larger, its inner margin being somewhat obliquely truncate, whilst the outer plate is the smaller, and is more or less pointed. Mr. A. White unintelligibly says, "small plates of the posterior ventral appendages larger and wider than the inner." As will be seen in our lower left-hand figure *v* at the head of this species, the outer plate (at the right side of the figure) is small and elongate-conic, the inner plate much larger, and somewhat obliquely truncate, whilst the basal portion is furnished with a conical point, extending half the length of the inner plate. The appendages as well as the edges of the terminal segment of the tail are strongly fringed with setæ. The legs are but slightly spinose and rather slender. The ridge between the base of the lower antennæ is not so narrow as in *C. spinipes*.

* M. Milne Edwards, in his generic character of *Cirolana*, describes the two plates of these lateral caudal appendages as being "à peu près de même grandeur," but in his description of *C. hirtipes* he says that "l'interne est plus large que l'externe," and in *C. elongata* "lame externe très petite, l'interne grande et arrondie au bout."

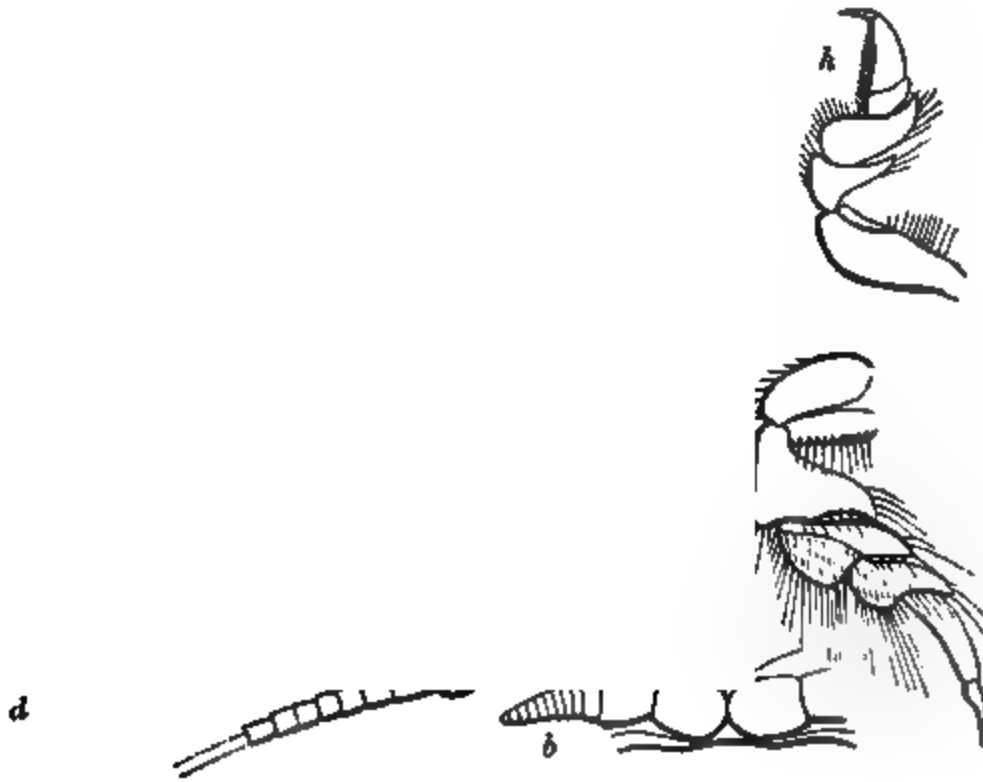
The original specimens of this species were forwarded to Dr. Leach from Falmouth (Cornwall), by Mr. J. Cranch. They have afforded the materials for our figure and description, and we have dredged a specimen, near the Knapbuoy, outside the Plymouth Breakwater, in about six fathoms of water. We have also received it from Mr. D. Robertson, of Glasgow, taken at Cumbrae.

The accompanying vignette of Dutch fishing boats is from a painting in the possession of J. Thackeray, Esq., of Amo Vale, Nottinghamshire.

ISOPODA.

ÆGIDE.

NORMALIA.



CIROLANA SPINIPES.

Specific character. Cephalon wider than long, with a curved incised line on each side parallel with the lateral margin. Pereion very convex, smooth. Pereiopoda strong and broad, armed with numerous spines; inner ramus of the posterior pair of pleopoda (uropoda) larger than the outer, elongate-ovate, acute at the tip, basal joint produced into a short subconical point.

Length, nearly one inch.

Cirolana hirtipes? MILNE EDWARDS, Crust. iii. p. 236, t. 31, f. 25.
 OUVIER, Règne Animal (Edit. Crochard), Crust.
 t. 67, f. 6? W. THOMPSON, in Ann. Nat. Hist.
 xx. p. 246. WHITE, B. M. Cat. Brit. Crust.
 p. 79. Pop. Hist. Brit. Crust. p. 850.

THIS species is at once distinguished from the typical *C. Cranchii*—the only one hitherto described as a native of Northern climates—by its robust form, convex glossy body, thick spinose legs, and by the shortness of the

produced inner angle of the basal joint of the lateral caudal appendages.

This last character, as well as the diversity of habitat, induce us to consider our second native species as distinct from the *C. spinipes* of Milne Edwards, who gives the Cape of Good Hope as its locality, with which it was considered as identical by Mr. A. White.

The general form is elongate-ovate, somewhat compressed at the sides, giving the body a convex appearance ; it is very glossy and impunctate ; the pleon is not quite so broad as the seventh segment of the pereion. The head is large, wider than long (in which respect also the animal differs from *C. spinipes* as described by Milne Edwards), somewhat rounded in front, marked at each side with the impressed line which appears to be a character of the genus. The upper antennæ are very short, composed of two small square flattened joints, with a short conical ten-jointed flagellum. The lower antennæ are nearly half the length of the body, composed of two very short and three long basal joints, and a long and slender flagellum, consisting of about twenty-four articuli. These antennæ are separated from each other at the base (when seen from beneath) by a narrow elevated ridge, below which is a broad, short upper lip, with the sides rounded, and the middle of the free margin slightly emarginate ; the mandibles are very robust, furnished with a triarticulate palpiform appendage (one of which is seen in our lower left-hand figure at *d'*). The legs are strong, with, especially, the middle joints broad, and subtriangular, their upper angle being produced into a point ; on the outside they are armed with numerous strong bristles or slender spines, a character which appears to us not to accord with Milne Edwards's description, "*pates très-poilues*," of his *C. hirtipes*. The

terminal segment of the pleon is as long as the preceding three segments united; it is somewhat triangular, with the lateral margins rounded and the extremity rather pointed; the lateral appendages of this segment are thin, the inner plate larger than the outer, elongate-ovate, scarcely pointed at the tip; and the basal joint is prolonged into a short triangular point, corresponding with the "grande dent lamelleuse et acérée qui atteint le milieu des lames terminales" of *C. hirtipes* as described by Milne Edwards.

A specimen of this species was first noticed by the late Mr. W. Thompson, which was procured in a fishing boat in Dublin Bay, by Mr. T. W. Warren, in 1847. This specimen has furnished the figures at the head of this description. Another specimen is in the British Museum, from Belfast Bay, taken out of a holibut, and several specimens are in the Hopeian collection, at Oxford, one of which is labelled "Brighton," and another was, we believe, taken off the Yorkshire coast. We have also received it from the Moray Frith, where it was taken by Mr. Gregor.

M. Hesse, Ann. des Sc. Nat. vol. v. p. 257, 1867, describes several species of this genus that he has taken burrowing in the sand on the coast of Brittany.

ISOPODA.

ÆGIDÆ.

NORMALIA.

Genus—CONILERA. (*Leach.*)

Generic character. Subcylindrical, pleon as wide as the terminal segments of the pereion, four anterior pairs of legs strong, three hind pairs slender; maxillipeds with the three terminal joints broad and flat, outer pleopoda divided into two nearly equal-sized joints.

THE very short characters given by Leach of this genus, and by Montagu of the only known species, having been insufficient to afford any true idea of the relations of the type, we are happy in being able to furnish detailed figures of the chief external organs.

The animal is nearly cylindrical in form, with the sides of the body nearly parallel, the head semi-oval, deeply immersed in the first large segment of the body, of which the anterior lateral angles are considerably advanced; the tail is composed of four nearly equal-sized, short basal segments (the first more or less concealed beneath the preceding), followed by the fifth, which is contracted at the sides, whilst the sixth is elongate-triangular.

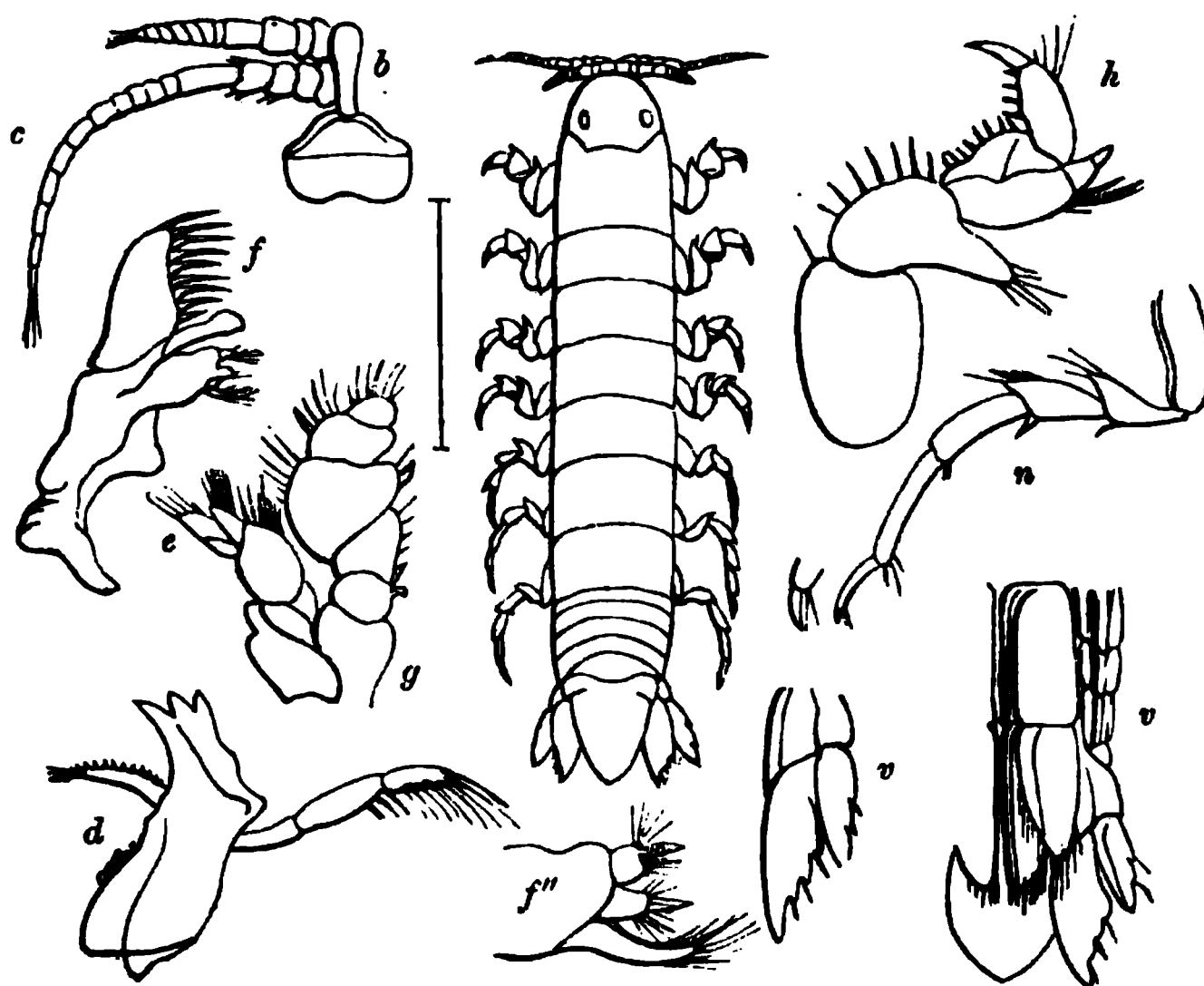
The upper antennæ are short, with the basal joints subcylindrical; the second pair are about twice the length of the preceding, separated at the base by a narrow ridge; the labrum is transverse, rounded at the anterior angles. The mandibles are tridentate at the tips, with a slender serrated inner movable lobe, and a three-jointed palpiform appendage. The maxillipedes or foot-jaws are

six-jointed, flat, with the three terminal joints very broad, and gradually decreasing in size. The first pair of maxillæ are terminated by two somewhat triangular ciliated lobes; the second pair of maxillæ are trilobed, the outer lobe subtriangular and armed with a row of strong bristles; the innermost lobe is compound, and terminated by three small appendages (fig. f''). The four anterior pairs of legs are robust, with the middle joints produced above into a strong angle. The three hind pairs are much more slender, and terminated by a very minute hook. The anterior pair of pleopoda are formed of two nearly equal joints, whilst the large lateral appendages of the last segment of the tail have the outer edges of the two divisions strongly notched.

ISOPODA.

ÆGIDÆ.

NORMALIA.



CONILERA CYLINDRACEA.

Specific character. Upper antennæ reaching to the eyes, lower antennæ reaching to half the length of the first segment of the body, inner division of the uropoda much larger than the outer, ovate, with the extremity pointed and the outer lateral margin notched, basal joint not having its inner angle produced into a point.

Length, about three-quarters of an inch.

Oniscus cylindraceus. MONT., Trans. Linn. Soc. vii. p. 71, t. 6, f. 8.

Conilera cylindracea. WHITE, B. M. Cat. Brit. Crust. p. 80. Pop. Hist. Brit. Crust. p. 252, pl. xiv. f. 6. GOSSE, Man. Mar. Zool. fig. 234.

Conilera Montagui. LEACH, Trans. Linn. Soc. xi. p. 370. Dictionn. Sci. Nat. xii. p. 349. DESMAREST, Cons. Crust. p. 305. MILNE EDWARDS, Crust. iii. p. 242. WHITE, B. M. Cat. Brit. Crust. p. 80.

Anthura cylindrica. LEACH, Trans. Linn. Soc. xi. p. 366. WHITE, B. M. Cat. Brit. Crust. p. 67.

THE whole upper surface of this animal is smooth, glossy and impunctate, of a pale yellow colour, clouded with cinereous on the sides. The eyes are small and distant apart; the antennæ short, the upper not extending beyond the eyes, composed of four rather strong sub-cylindrical basal joints, and a flagellum of about seven articuli; the lower antennæ (separated from each other by a narrow raised ridge) are rather more than twice the length of the upper pair; they consist of four short basal joints, a fifth slender joint, and a flagellum with about twelve articuli. The labrum is transverse, with the anterior angles rounded, and the middle of the free margin slightly emarginate. The mandibles are robust and horny, with the apex incurved and three-toothed, the middle of the inner margin furnished with a slender movable appendage slightly serrated on its upper edge; the foot-jaws are broad, shutting the mouth from below, six-jointed, the three terminal joints broad and flat, with their outer margins setose. The first pair of maxillæ are composed of a broad basal joint terminated by two somewhat conical lobes, of which the outer is divided into two parts by an oblique articulation. The second pair of maxillæ (represented more magnified than the preceding mouth-organs) are terminated by three lobes, of which the outermost is largest, somewhat triangular, and furnished with strong bristles on its inner edge; the middle lobe is a slender simple piece, but the innermost lobe is much more complicated, terminated by three small pieces, of which the outer is slender, curved, and setose at the tip; the two inner lobes are of equal size, conical, and strongly and transversely verticillated across their centre. The three fore pairs of legs are short and very robust, with the middle joints broad, flattened, and produced into an angle on

the outside and serrated on the inside. The fourth pair of legs are intermediate in size, between the three fore and three hind pairs, which latter are slender; all the legs are terminated by a small hook-like finger, which appears to be articulated at its tip in the hind legs.

The terminal segment of the tail is obconical, with the sides slightly curved and the extremity rather rounded. The anterior pair of pleopoda are strong, and form an operculum, of which the basal joint is large and oblong, and the two terminal divisions unequal, the inner one being the larger, with its inner edge straight, whilst the outer one is more ovate; the lateral appendages are also unequal, the inner lobe being the larger and ovate, with its apex acute, the outer margin beyond the middle somewhat notched and spinose.

It will be seen by a comparison of our description and figures of the parts of the mouth with those of the genus *Cirolana*, given in the Crochard edition of the "Règne Animal," that this animal is closely allied to the last-named genus, and that it has no other relation with *Anthura* than its narrow cylindrical form.

The species was first obtained by Colonel Montagu on the coast of Devonshire; we have procured it by dredging in the Sound, and in six fathoms near the Knap Buoy, and from trawlers off Plymouth, and have received it from Mr. Loughrin from Polperro, and from the Frith of Clyde, taken by the Rev. A. M. Norman. Dr. Lukis, of Guernsey, took upwards of a dozen specimens feeding together within the orbit of the eye of a whiting, the eyeball of the fish being nearly detached from the surrounding parts. The fish did not seem to be out of condition, although the parasites must have been there some time, as they were remarkably blanched.

ISOPODA.
NORMALIA.

ÆGIDÆ.

Genus—EURYDICE. (*Leach.*)

SLABBERINA. (*Van Beneden.*)

Elongate-ovate, moderately convex; upper antennæ very short, cylindrical; lower antennæ long, with a multiarticulate slender flagellum; legs small; uropoda with the inner division larger than the outer, and hatchet-shaped.

THE only two characters given by Dr. Leach of this genus, namely, the “abdomen composé de 5 articles,” and “yeux lisses,” which are described as separating it from *Nelocira* (in which the pleon is described as having five segments, and the eyes being granular), and also from *Cirolana* (in which the pleon has six segments, the eyes being also granular), are unsatisfactory, and have induced M. Milne Edwards to unite *Nelocira* with *Eurydice*, especially as the figure given by Desmarest of the former of these two genera represents it with a six-jointed tail; whilst Van Beneden expressly says that the eyes are distinctly faceted in the animal, which he has described and figured under the name of *Slabberina agata*, and which is certainly identical with the *Eurydice pulchra* of Leach.

Van Beneden, moreover, represents the tail as formed of a large exarticulate mass, in which the five anterior segments are only indicated by partial longitudinal markings on the skin, followed by a sixth narrow segment and a seventh large terminal semi-ovate one.

He also describes and figures the upper antennæ as

x 2

composed of only three joints. A very careful examination of the species has, however, shown that in all these characters Van Beneden has fallen into some unaccountable error. The eyes under a strong lens are not faceted. The seventh or last segment of the body is considerably shorter than the sixth; the first segment of the tail is still shorter and abbreviated at the sides, whereas the second, third, fourth, and fifth segments are of equal size, perfectly distinct in their articulations, and with the posterior-lateral angles of each produced into an acute point like the terminal segments of the body; the sixth or terminal segment of the tail is of large size, semi-ovate, and has a deep transverse impression near the base (this impression is not represented in our outline figure, but it seems to correspond with Van Beneden's narrow penultimate segment).

The upper antennæ are very short and cylindrical, composed of three basal joints, arising from a fixed base, the third being as long as the two preceding joints taken together, followed by three small articuli, of which the last is very minute, and almost concealed by terminal setæ. The lower antennæ are about two-thirds of the length of the animal, having five basal joints, thicker than the remainder, extending to the extremity of the upper antennæ, followed by a long very slender flagellum, composed of a great number of minute articuli. The mandibles are horny, with several conical teeth at the tip, and with a slender movable blade attached to the inner margin, having a finely serrated upper edge. They externally bear a slender three-jointed palpiform appendage.

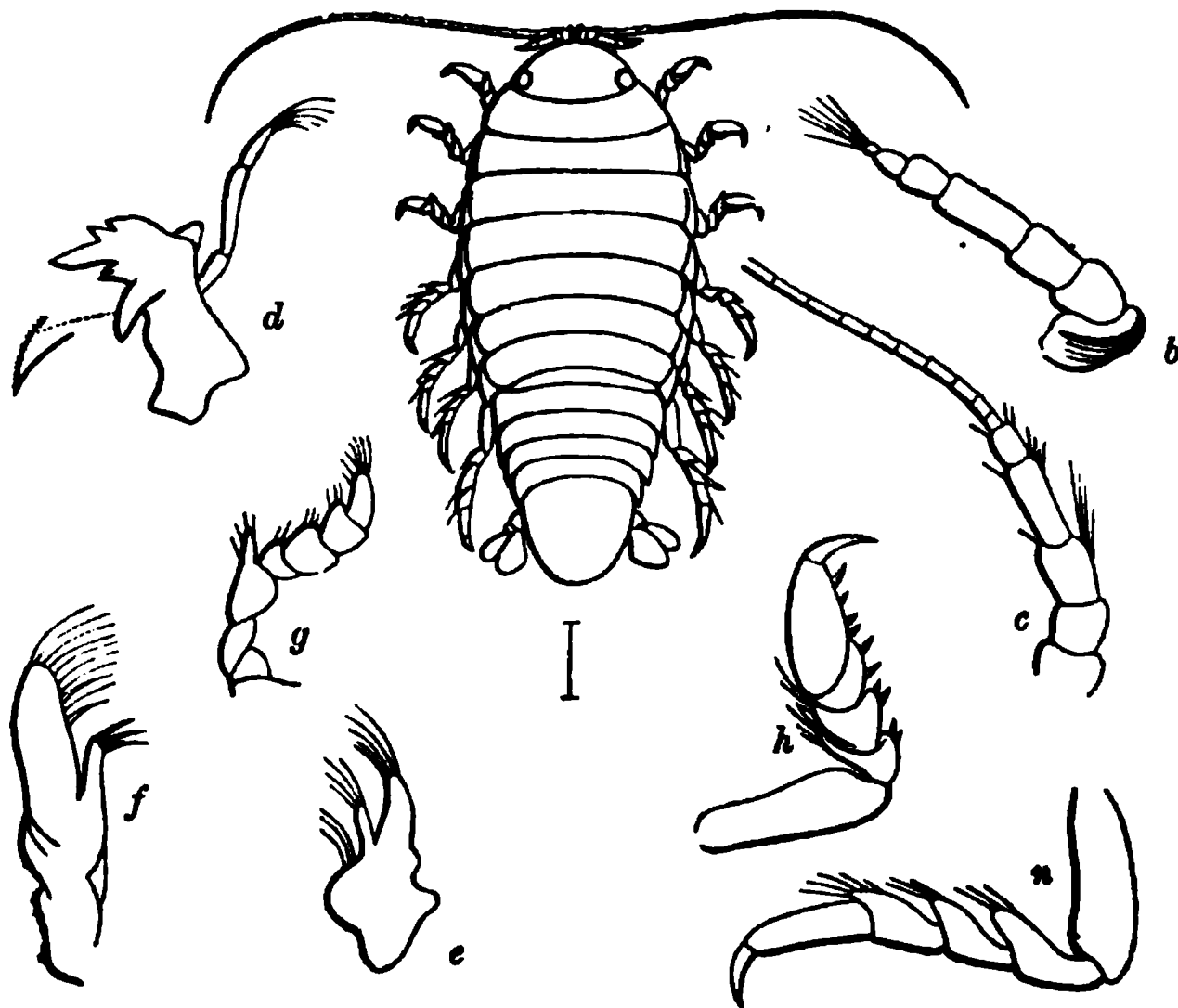
The foot-jaws are six-jointed, the joints of moderate width, the second having the inner apical angles produced, the remainder being armed with bristles on the

inner edge ; the outer maxillæ (*e*) are apparently formed of three closely soldered joints, indicated by bristles, on the inner edge, the second and third joints being produced on the inner margin. The inner maxillæ are bilobed, the outer division broader than that of the outer pair, and armed with stronger bristles, the inner division minute and armed with bristles set on at right angles.

The four anterior pairs of legs are rather shorter than the three posterior ones, the former being armed with short spines on the lower edge, whilst the hind ones are smooth, having the outer angles of the middle joints conically produced and setose. The uropoda, or lateral appendages of the tail, arise on each side from a broad basal joint, the inner division being larger than the outer and obliquely truncate at its extremity ; both having ciliated margins.

ISOPODA.
NORMALIA.

ÆGIDÆ.



EURYDICE PULCHRA.

Specific character. Eyes not faceted, body semi-transparent, pale ashy colour, figured symmetrically with dark markings, resembling the star-like spots in agate, basal segments of the pleon with a large transverse mark on each side formed of small black lines.

Length, one-quarter of an inch.

Agaat Pissebet. (ONISCUS) SLABBER, Naturk. Verlust. p. 149, pl. 17, f. 1, 2.

Eurydice pulchra. LEACH, Trans. Linn. Soc. xi. p. 370. Dictionn. Sci. Nat. xii. p. 347. Suppl. Enc. Brit. i. p. 428. SAMOUELLE, Entom. Compend. p. 109. DESMAREST, Cons. Crust. p. 302. MILNE EDWARDS, Crust. iii. p. 238. W. THOMPSON, in Ann. Nat. Hist. xx. p. 240. WHITE, B. M. Cat. Crust. p. 79. Pop. Hist. Brit. Crust. p. 250. GOSSE, Man. Mar. Zool. i. fig. 231. HESSE, Observations biologiques sur quelques Crust. des Côtes de Bretagne, Ann. des Sc. Nat. v. p. 242 (1866.)

Slabberina agata. VAN BENEDEN, Recherches sur la Faune litt. Belg. p. 88, pl. 15 (1861).

THIS beautiful little species was first described and figured by Slabber, in his fine microscopical work above referred to. His article on it has, however, been overlooked by all carcinologists, except Van Beneden, who has published a detailed account of it in his researches on the littoral fauna of Belgium, and who remarks that no naturalist had reobserved Slabber's animal; this is not indeed surprising, since the description of it by Leach (which has hitherto served for all subsequent writers on this tribe) is so short and unsatisfactory as not to be readily recognized.

The body is smooth and of a pale grey colour, each segment marked with about eight or ten black dots formed of delicate radiating lines, closely resembling the markings upon certain varieties of agate; these spots are arranged transversely and with a great amount of regularity upon the succeeding segments; each of the basal joints of the tail, on the other hand, is marked with two transverse spots formed of a series of very fine black lines; the large terminal segment is transversely depressed near the base; the tail is furnished on its underside with five pairs of foliaceous membranous plates, each articulated across the middle, the basal division being almost square, and the apical division nearly semi-circular, the latter fringed all round with about twenty-five very fine hairs, each of which is fringed along its whole length with most delicate cilia; the outer pair of the caudal plates do not perform the duty of an operculum as in the Idoteæ, and the sides of the terminal segment are furnished with lateral appendages, the outer division of each of which is smaller than the inner portion, which is obliquely truncate at its extremity, and hatchet-shaped.

This species is found in small pools left by the re-

tiring tide, where it swims about with the utmost celerity. It is not difficult to keep it alive in confinement, Slabber having kept one for nine days in the month of August. It occurs on the coast of Devonshire, where it was taken at Bantham by Dr. Leach, and in South Wales by ourselves, on Loughor Marsh, and on a cuttlefish shell on the beach in Caswell Bay, and Mr. W. Thompson obtained it from Larne. Van Beneden states that he only found it in summer; it was, however, taken at Carrickfergus, by Mr. Hyndman, on the 17th of March, 1840.

M. Hesse has found it burrowing in sand on the coast of Brittany. The Rev. A. M. Norman has sent it to us from the coast of Northumberland and Durham, and Mr. Walker of Brookfield, near Cheshire, writes us that "*Corophium longicorne* and *Eurydice pulchra* are the commonest crustacea in the Dee, at least at Bagillt, where his observations have been made. "The latter," he says, "is a most savage little beast. If you are a moment still in the water while bathing, dozens will fasten upon you and nip most unpleasantly. I have had to jump into the water again after coming out from bathing and splash violently to get rid of the hosts that had stuck to me while clinging to the side of the boat preparatory to getting in. They continue to bite after you are out of the water. I once put a wretched *Hyperia* which I had taken from a *Rhyzostoma*, into a small bottle with two *Eurydices*; the bloodthirsty little brutes attacked him at once like tigers, and soon sucked his shell clean."

Tribe—LIBERATICA.

THE remainder of the aquatic Isopoda are free in their habits, not residing as parasites on the bodies of fishes or other sea animals. Their legs are consequently not formed for prehension or attachment to their prey, nor armed with a strong hook at the extremity, but, on the contrary, they are slender, and generally of uniform size and structure, and fitted for locomotion. They constitute five families—*Asellidæ*, *Munnopsidæ*, *Arcturidæ*, *Idoteidæ*, and *Sphæromidæ*.

Family—ASELLIDÆ.

THE animals composing this family are of a sub-depressed form; and have not the posterior pair of pleopoda developed into an operculum to the remainder of the respiratory apparatus (in which respect they differ from the *Idoteidæ* and *Arcturidæ*, whilst the *Sphæromidæ* have the body very convex, and capable of being rolled up into a more or less perfect ball). The mandibles are armed with a palpiform three-jointed appendage; the first two or basal joints of the foot-jaws are strongly produced on the inner margin, and the outer maxillæ terminated by three large flattened membranous plates.

The genus *Limnoria* differs in several important respects from the other genera of this family, and was in fact considered by Dr. Leach to form a separate class amongst his *Cymothodes*.

ISOPODA.
NORMALIA.

ASELLIDÆ.

Genus. JÆRA. (*Leach.*)

Generic character. Upper antennæ very short. Lower antennæ more than half the length of the animal. Legs uniform, slender. Pleon coalesced into one segment, furnished with two minute subterminal uropoda. Pleopoda or branchial appendages covered by a large plate occupying the entire under surface of the pleon. Dactyla biunguiculate.

THE small flattened species, which is the type of the present genus, is distinguished from the allied genera by the minute upper antennæ and terminal appendages to the tail, the claws with which the moderately long slender uniform feet are furnished at the tip, and especially the very remarkable structure of the under surface of the tail. The body is considerably flattened, and elongate-ovate (or narrow in some exotic species). The head is not soldered to the following segment of the body; its sides are rounded, having, like the segments of the body and the tail, a thin lateral margin. Its fore margin is bi-emarginate, the antennæ not having their basal joints concealed, but arising within the emargination. The upper or inner antennæ are very small and four-jointed, not extending to the third joint of the outer pair, which are considerably more than half the length of the entire animal, with the two basal joints short, the third twice the length of the preceding, the fourth long and more slender, but thickened towards the tip, followed by a very long and slender multiarticulate flagellum. The

mandibles are strong, horny, curved inwards at the tip, and armed with several teeth, the lowest of which is truncate. They are provided with a three-jointed palpi-form appendage. The basal joint of the foot-jaws is large and triangular, with the tip ciliated, followed by five joints, of which the distal ones are the most slender. The first pair of maxillæ are furnished at the extremity with three oval membranous plates, ciliated at their extremities, the anterior one being the largest. The second maxillæ are composed of two branches, of which the outer one is the larger, and armed at the tip with strong bearded bristles.

The segments of the body are strongly marked by lateral incisions, the sides being rounded, and the posterior-lateral margins not produced into a point. The legs are of moderate size, being nearly uniform both in length and thickness, and terminated by two small hooks of nearly equal size. The female carries between the base of the legs an ovigerous pouch, composed of delicate membranous plates, within which the young are developed. The tail consists of only a single plate, formed by the coalescence of all the segments of the pleon, which is semicircular (or semi-ovate) in form, and, in our British species, with a small semicircular incision in the middle of the posterior margin, within which are attached the two very minute terminal appendages, each of which consists of a square flat joint, supporting two extremely minute conical plates, of which the outer one is almost obsolete; the tips of these plates are furnished with hairs. In *J. Kröyeri* the tail has two small semicircular incisions, between which the centre is produced into a small point, and the appendage on each side consists of a small square basal joint, supporting two minute oval plates.

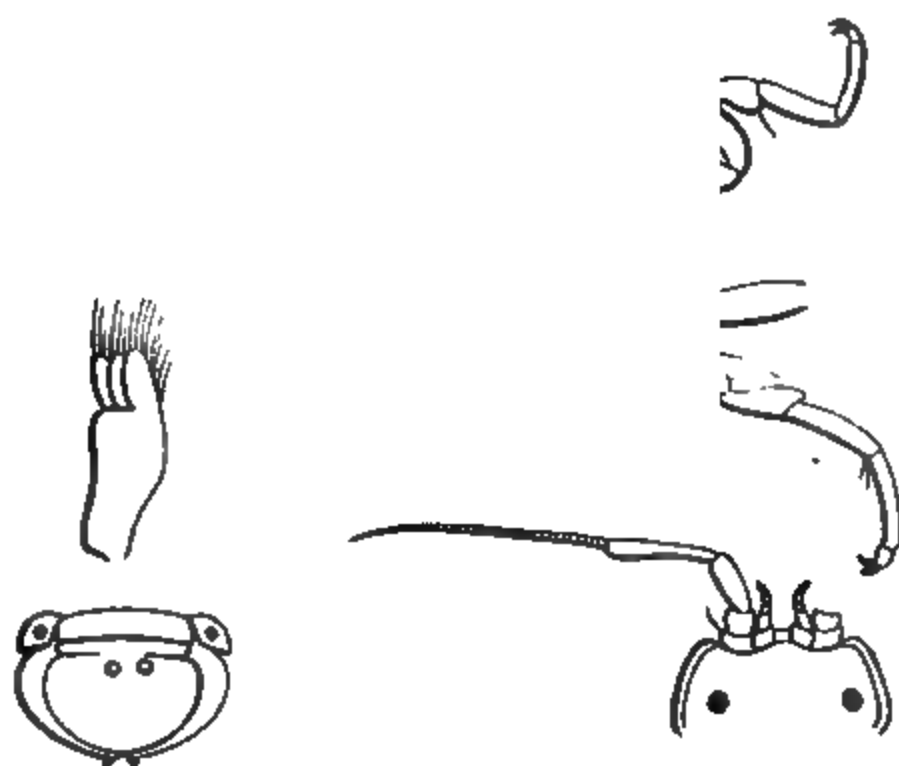
We have been under the necessity of sinking the genus *Jæridina* of Milne Edwards since our discovery that the "absence de la grande lame operculaire," which in *Jæra* "remplace les premières fausses pates," is a sexual character. The type *J. Nordmanni* of Rathke must, moreover, be removed from *Janira*, to which genus it was referred by the last-named author, as it wants the long styliform processes at the end of the tail.

The following vignette of Brighton Fishermen was kindly done for this work by Mr. Jennings.

BRIGHTON FISHERMEN.

ISOPODA.
NORMALIA.

ASELLIDÆ.



JÆRA ALBIFRONS.

Specific character. Subovate, very depressed, sides of the cephalon, pereion, and pleon margined. Colour cinereous, with the anterior margin of cephalon whitish.

Length, about one-sixth of an inch.

Oniscus albifrons.

MONTAGU, MSS. in Brit. Mus.

Jæra albifrons.

LEACH, Edinb. Encycl. vii. p. 434. Trans. Linn. Soc. xi. p. 373. Suppl. Enc. Brit. i. 423. SAMOUKELLE, Ent. Compend. p. 110. DESMAREST, Cons. p. 316. MILNE EDWARDS, Crust. iii. p. 150. W. THOMPSON, in Ann. Nat. Hist. xx. p. 245. WHITE, B. M. Cat. Brit. Crust. p. 69. Pop. Hist. Brit. Crust. p. 231. GOSSE, Man. Mar. Zool. i. fig. 243.

Jæra nivalis?

KRÖYER, Grönlands Amphipod. p. 75, pl. 4, fig. 21a—k. MILNE EDWARDS, O. C. p. 149.

Oniscus marinus?

O. FABRICIUS, Fn. Grœnl. p. 252, n. 229.

THE accompanying figure of this species has been made from Colonel Montagu's typical specimens, described by Dr. Leach, in the British Museum. Not only do they differ from the *J. Krøyeri* of Milne Edwards, from the shores of La Vendée, in their much broader form, but they agree in this respect with Krøyer's figure of *J. nivalis*, from Greenland, whilst the description of the tail given by Otho Fabricius of his *Oniscus marinus* ("cauda subciliata et extremitate incisuram vix notabilem habens, de qua styli duo brevissimi, acuti, distantes") seems also to accord with other British species. Dr. Leach, indeed, describes the eyes in his species as being "placed close together," but this character neither agrees with the type nor with the descriptions and figures of Krøyer and M. Edwards. The upper surface of the body is flattened and marked with irregularly impressed lines. The lower or outer pair of antennæ are considerably more than half the length of the animal. The tail is much wider than long, being nearly semicircular in form, having two small impressed dots a little apart towards its basal portion; the centre of the caudal margin has a nearly semicircular notch, with the centre of the incision slightly produced into an obtuse point, on each side of which are implanted the minute uropoda.

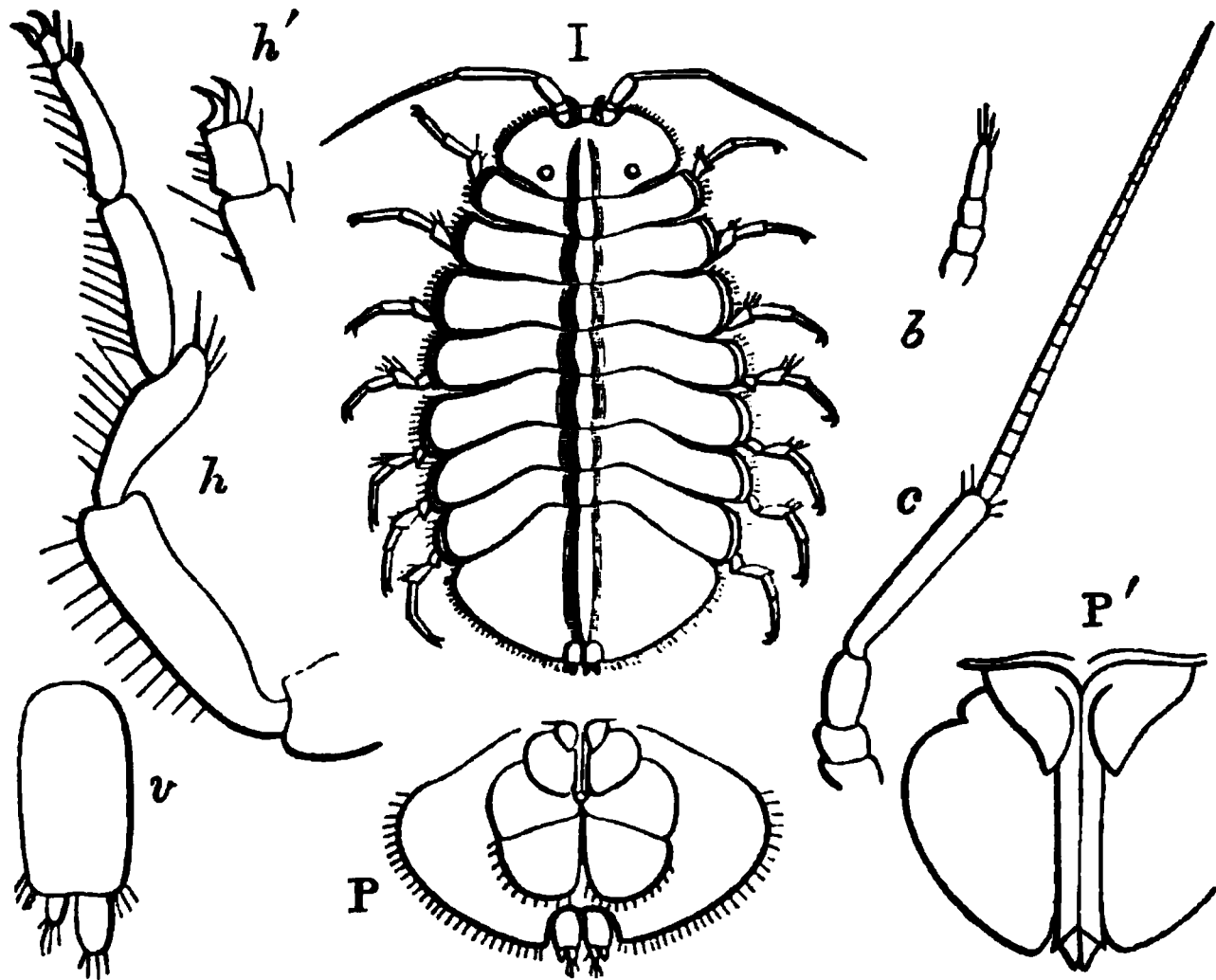
The general colour is ashy, but very much varied in its shades in dried specimens, with the front of the head whitish.

Jæra Hopeana of Costa (Faun. d. Regn. di Napoli fasc. 83, tav. iii.) appears to us identical with the present species, agreeing with it (contrary to Signor Costa's statement) in the position of the eyes; the only apparent difference consisting in the equal size and apparently three-articulated structure of the two appendages of the minute terminal uropodæ.

J. albifrons probably occurs all round our coasts. We have it recorded on the Devonshire and other coasts, among sea-weeds and under stones, in many parts of the British islands. It was found especially abundant in crevices of rocks at half-tide near Falmouth, by Mr. W. P. Cocks, and we have taken it abundantly beneath and generally attached to the under surface of stones between tide-marks in Plymouth Harbour, the flat surface of the body enabling the animal to ensconce itself in very slight crevices. The late Dr. Johnston also forwarded it to us from the Berwickshire coast.

ISOPODA.
NORMALIA.

ASELLIDÆ.



JÆRA NORDMANNI.

Specific character. Broadly ovate ; sides of the segments strongly ciliated, with hairs set on at right angles ; upper antennæ four-jointed, terminal joint not multiarticulate ; lower antennæ not more than one-third of the length of the animal, with the third joint not half the length of the following ; pleon with a deep semicircular notch, within which the two small caudal appendages are visible, extending very slightly beyond the margin.

Length, about one-sixth of an inch.

Janira Nordmanni. RATHKE, in Mém. des Sav. Étrang. de St. Petersb. (Fauna der Krym.), t. iii. pl. 6, figs. 1—5, p. 388.
Jæridina Nordmanni. MILNE EDWARDS, H. N. Crust. iii. 150.

THIS small animal was arranged by its first describer, Rathke, as a species of *Janira* ; but that genus possesses elongate appendages at the extremity of the body, as in the common *Asellus*. Professor Milne Edwards accord-

ingly removed it therefrom, and formed for its reception a new genus, *Jæridina*, in consequence of the branchial apparatus on the underside of the tail not being covered by a "grande lame operculaire qui chez eux remplace les premières fausses pates" (which had been given as the generic distinction between *Asellus* and *Jæra*). Having, however, ascertained that this "grande lame" is a sexual distinction peculiar to the females, we are under the necessity of referring the new species to the genus *Jæra*, with which it agrees in all its essential characters.

It is considerably broader than *J. albifrons*, the lateral margins being very thin and dilated, as well as ciliated with rather strong bristles set on at right angles, a peculiarity of structure eminently fitted for enabling the animal to reside in flat crevices, beneath stones, &c., in situations often uncovered by the tide; the ciliation of the sides of the body serving for the retention of the fluid which supplies the material for respiration; just as in many insects residing in occasionally submerged situations under stones, it maintains a supply of air for the like purpose. The head is deeply incised in front, for the reception of the antennæ, the inner pair of which are very short, and four-jointed, the terminal joint offering no apparent trace of articulation; the outer antennæ are not more than one-third of the length of the animal, the third joint being only about twice the length of the preceding, and not half as long as the following joints, the flagellum is very slender and multi-articulate. The terminal segment, or tail, is large and semicircular, with a rather deep semicircular incision at its extremity, within which are affixed the two caudal appendages, consisting of a small oblong basal joint, at the extremity of which are attached two small scales, the outer one being extremely minute and conical, the

inner one large and oval, setose at the tip. The outer ventral scales are free, forming together nearly a circle, each divided into two nearly equal parts by a somewhat diagonally-placed articulation; at their base is attached, in the males, two minute triangular plates and the elongated male organ, which extends to the above-mentioned articulation. The legs are terminated by two minute curved ungues.

Rathke obtained his specimens at Cape Parthenon, in the Crimea, under stones; our specimens were taken at Plymouth, and in Llangland Bay, South Wales.

ISOPODA.

ASELLIDÆ.

NORMALIA.

Genus—MUNNA. (*Kröyer.*)*Male.* Elongate, sublinear. *Female.* Broad, ovate.

First and seventh segments of the pereion shorter than the rest; cephalon very broad and large, occupying nearly one-fifth of the whole length of the animal. Eyes very large, fixed at the postero-lateral angles of the cephalon, pedunculated, immovable. Upper antennæ very short; lower antennæ very long. First pair of legs small and strong; the remainder very long and slender, terminated by two small ungues. Pleon having all the segments coalesced into a single elongate pear-shaped plate.

THE large size of the head, together with the very prominent, pedunculated (although not movable) eyes, which stand out, in the males, considerably beyond the lateral margin of the body, gives a very distinctive character to this genus; and the great length of the lower antennæ and legs, giving the animals the appearance of one of the *Nymphonidæ*, at once separates it from all the other genera in the present family. The facets of the eyes are large and hexagonal; the antennæ are inserted at a considerable distance apart (represented in our lower left-hand outline in the woodcut of *M. Kröyeri*), the upper pair consists of several very short joints, followed by a long, slender portion, which is exarticulate in *M. Whiteana*, but distinctly consists of three joints in *M. Kröyeri*; this portion is terminated by two flattened (and articulated?) setæ at the tip, at the base of which are affixed two or three very minute joints, observed only by us in *M. Whiteana*, and which constitute the true flagellum. The lower antennæ are very long,

exceeding the whole animal in their length, with a four or five-jointed peduncle (of which the two last joints are long and subequal), and a multiarticulate flagellum half the length of the entire antennæ. The segments of the body are subequal in length, but the first and seventh are often shorter than the rest: in the males, the body is narrow, with the sides parallel; but in the female, the outline of the animal is ovate, or pear-shaped. The foot-jaws consist of a large basal joint, armed at the base with an elongated triangular scale, and produced on its inside into a flattened blade, rounded at its extremity and ciliated, and followed by four distinct joints, gradually becoming more slender, and furnished with strong bristles at their distal extremities. The mandibles are robust, and armed on the inner edge with a strong molar tooth, and at the base, on the outside, with a three-jointed palpiform appendage. The fore legs are short but strong, and furnished with a subcheliform hand, whilst the six remaining pairs of legs are very long, and terminated by two long, slender, simple ungues. The tail consists of a single piece, of a flattened ovate form, narrower than the segments of the body. We presume that in this genus the sexes are distinguished by the same condition of the branchial plates as we have above stated to occur in several of the other genera of this family. Kröyer, in his characters of the genus, says "*unica* infra lamina præditum tectoria," whilst H. Goodsir represents the "abdominal plate," as he terms it, as composed of two long and narrow pieces soldered together along their inner margins, copied in our cut of *M. Kröyeri*; but on referring to Kröyer's original description, we perceive that it is taken from the female of *M. Boeckii*, whilst H. Goodsir's description is taken from a male animal.

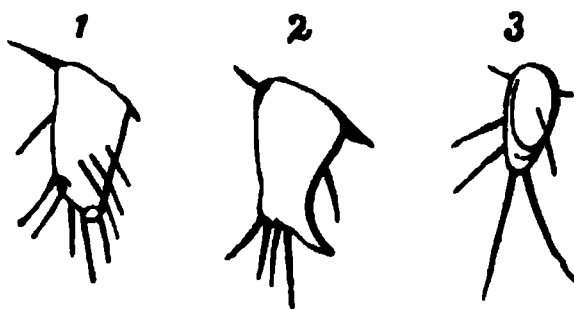
The eggs in this genus are carried in a large ovisac, situated between the middle legs, and composed of four large plates.

As it is very probable that Kröyer's two species will be discovered in our northern seas, we add his characters of both.

Munna Fabricii, Kr., abdomen ovale vel subellipticum, aperte longius quam latum; appendicibus caudalibus rudimentariis sed sat distinctis. Annulus thoracicus septimus sat distinctus.

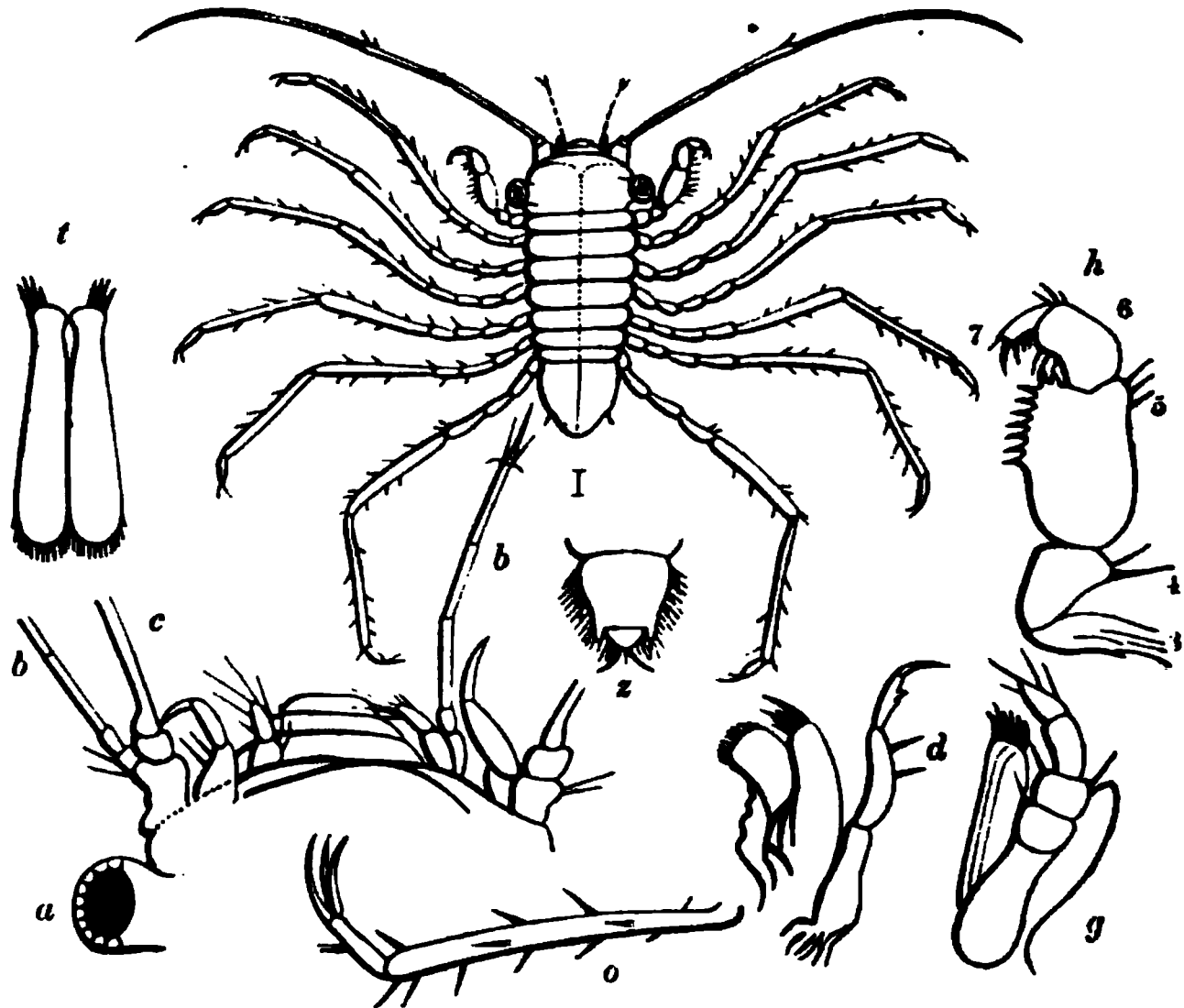
Munna Boeckii, Kr., abdomen capite aperte longius subconicum non multo latius quam longum, appendicibus caudalibus fere evanescentibus; annulus thoracicus septimus parum distinctus, sexto multo brevior.

The following vignette represents the rudimentary uropoda of—1. *Munna Kröyeri*. 2. *Munna Whiteana*. 3. *Leptaspidia brevipes*.



ISOPODA.
NORMALIA.

ASELLIDÆ.



MUNNA KRÖYERI.

Specific character. Male with the eyes very prominent, extending considerably beyond the pereion. Pereion setose. Pleon scarcely longer than wide. Carpus of first pair of gnathopods thick, with strong spines on the under edge, and two strong spurs at the tip beneath. Upper antennæ terminated by two long articulated setæ, and a very minute flagellum.

Length, one line.

Munna Kröyeri. Gooden, Edinb. New Phil. Journ. xxxiii. p. 365, t. 6, f. 6 (1842). W. THOMPSON in Ann. Nat. Hist. xx. p. 247. WHITE, B. M. Cat. Brit. Crust. p. 70. Pop. Hist. Brit. Crust. p. 231, pl. xiii. f. 3.

THE male of this species has only hitherto been observed. It has the "whole body very setose, and is of an ochrey-brown colour, except the reticulated portion of the eyes, which are black. The head is large, rounded anteriorly, and slightly pointed in the middle. The ter-

minal joints of the foot-jaws are seen projecting in front of the anterior edge, and they are always in motion. The dorsal surface of the head is quite smooth, and the internal or superior antennæ arise from it within the margin, and a little anterior to the eyes; they are composed of a peduncle of three articulations, and of a double multi-articulate setaceous portion, which arises from the last joint of the peduncle: these are very slender, and incline towards one another at their extremities; the whole organ is equal in length to the two first joints of the inferior antennæ and the proximal half of the third joint. The external antennæ are much produced, being considerably longer than the body; the peduncular portion is composed of four joints; the setaceous flagellum is multiarticulate; two large blood-vessels are seen running through these organs. The eyes are large and pedunculated, but quite immovable; the reticulated portion is small, and is almost altogether confined to the lower surface.

“ The first six segments of the body are almost equal, the seventh is obsolete. The first pair of legs are prehensile, and the mechanism is rather curious; the fifth joint is very large and rounded, the inferior angle of its distal extremity is armed with four large and strong teeth, two of which are large, the other two being smaller; the sixth joint is not so large, and is reniform; the seventh joint is long and pointed, bearing at its extremity a strong claw. The following six pairs of feet are ambulatory. They are very spiny, and the last joint is armed with two strong claws, which are not placed in the usual way, but with the one above the other; the superior is largest and strongest. The tail is composed of two segments: the first, which is largest, is of a square shape, and is armed with two strong spines at its pos-

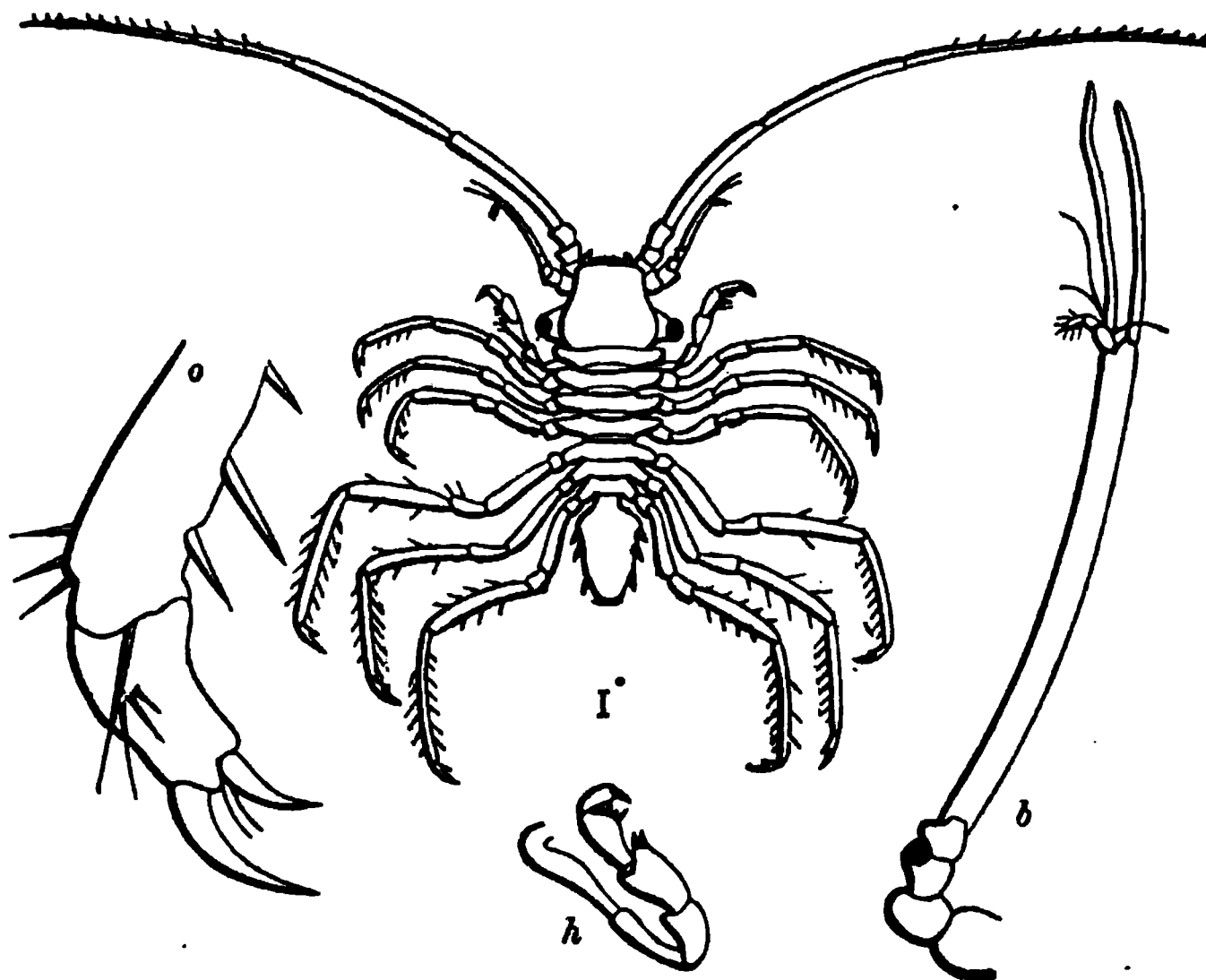
terior angles. The last segment is almost triangular; the apex being directed posteriorly, two small styles arise from each side of the apex."

[We have copied Mr. Goodsir's figure of the tail at *x*, which shows that there is only one pair of caudal styles, and not two pairs, as his description would lead us to infer.] "All the external margins of both of these segments are thickly fringed with minute hairs and spines. The branchiæ are almost semicircular, and each of them is armed on its internal edge with a small appendage. The external plate of the branchiæ is extremely narrow, and is not composed of two equilateral pieces, as in the other *Asellidæ*, but consists of one piece only, with an immovable suture in its mesial line. It is attached to the body by its base only."

This species was found by the late Mr. H. Goodsir in the Frith of Forth. It is quick and active in its movements, running among the branches of coralline with great rapidity. Mr. Goodsir never observed it swimming, its legs being, indeed, unfitted for that kind of locomotion; when pursued along the bottom, it runs quickly, but often stops suddenly, turns round, and assails its annoyer. We have received it from Mr. Robertson, who took it at Kames Bay, and from the Rev. A. M. Norman, who found it at Cullercoats and Seaham.

ISOPODA.
NORMALIA.

ASELLIDÆ.



MUNNA WHITEANA.

Specific character. Male, with the cephalon nearly half the length of the pereion, with the eyes very wide apart, fixed on thick peduncles. Upper antennæ with four very short basal joints, followed by a very long slender one, terminated in a short triarticulate flagellum, and two long auditory cilia. Pleon about as long as the cephalon, narrower than long, armed with three strong teeth at each side.

Length, rather more than half a line.

THE head is very large and broad, increasing in width posteriorly, equal in length to the three following segments; the eyes are fixed on very thick and prominent peduncles. The front of the head is nearly truncated, and the upper antennæ are affixed widely apart next the anterior-lateral angles of the head. The peduncle consists of four very small joints, of which the first is most robust, and a fifth, that is very long and slender,

which is terminated by a flagellum composed apparently of three very minute articulations, at the base of which arise two delicate, slender filaments or auditory cilia, about half the length of the preceding joint. The lower antennæ are much longer than the entire animal, and consist of three small basal joints, followed by two long and slender ones, occupying nearly half the length of the whole antennæ, followed by a long and slender multiarticulate flagellum. The first segment of the body is nearly as large as each of the three following, whilst the three terminal segments gradually decrease in width and length, each having the sides produced into rounded lobes. The tail is elongate-ovate in form, constricted at the base, with three strong teeth on each side, the last part being affixed in a slight incision on each side near the tip, and apparently representing the minute caudal appendages.

The fore legs are short and subchelate, the three following long and slender, whilst the three posterior pairs are still longer, all except the anterior pair being terminated by two strong curved ungues of unequal size. This species was first named by us *Monimia Whitiana*, in compliment to Mr. Adam White, late of the British Museum, and described at the meeting of the British Association for 1852, from a specimen obtained at Weymouth by Professor Williamson; and we have since received it from Cumbræ, where it was taken by Mr. David Robertson, of Glasgow, amongst the fibres of the nest of *Lima hians*. They were generally much covered with particles of fibre, and were sluggish in their movements.

ISOPODA.

ASELLIDÆ.

NORMALLA.

Genus—LEPTASPIDIA.

Generic character. Animal pear-shaped, flattened, ciliated along the margins; inner pair of antennæ nearly one-third of the length of the outer pair; legs terminated by single acute dactylos; pleon ovate, extremity entire; uropoda lateral; eyes obsolete.

WE have established this genus for the reception of a minute animal, which differs in several of its characters from the rest of the family, but agrees with them in the dilated form of the body, with the margins of the segments ciliated, and the semi-circular form of the head, with the lateral posterior angles rounded. We have not observed the eyes in our unique specimen. The upper or inner antennæ, which are most probably represented in our cut too wide apart, are nearly one-third of the length of the outer pair, which latter are about half the length of the animal, and appear to consist of three nearly equal-sized basal joints, and an articulated flagellum. The segments of the body are rounded and ciliated, gradually decreasing in width and length from the second joint. The legs are extremely short and slender, the anterior having the wrist and hand somewhat thickened, all terminating in a single slender and acute finger. The tail resembles that of the genus *Munna*, and is oval in shape, flattened and ciliated with a slight notch on each side beyond the middle, each impression bearing a small conical appendage (uropoda), the extremity being produced back-

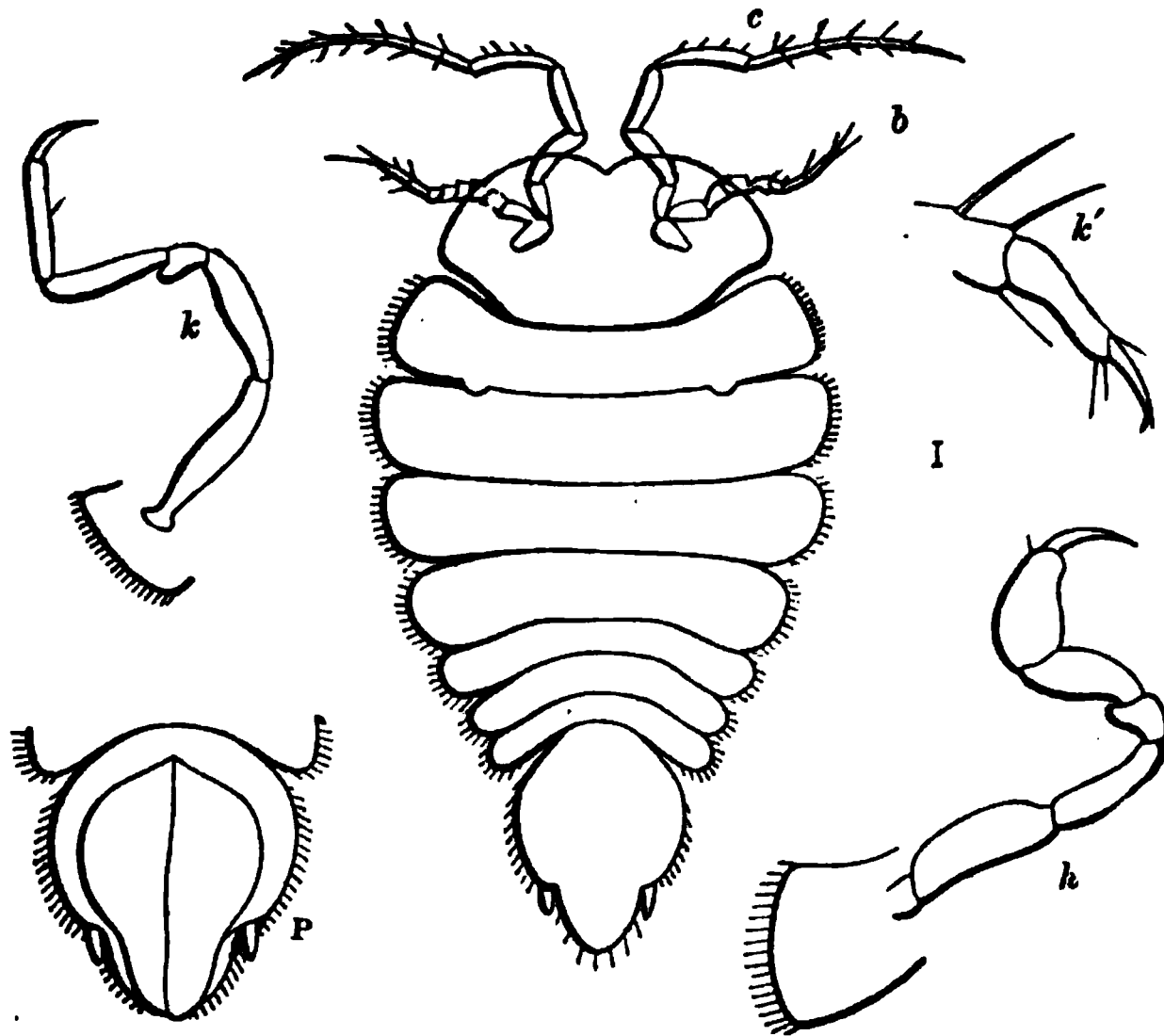
wards, rounded and entire, resembling the minute appendages existing on the telson of some Stomapod crustacea. The outer pair of branchial plates shut together in the form of a flattened pear, divided down the centre: they cover the greater part of the underside of the tail.

We have but little hesitation in classifying this genus with those that Professor Sars and his son have described under the name of *Isopoda Remagantia*, and for which Professor Lilljeborg has established the family of *Munropsidæ*, and which are pointed out by Professor Krøyer as having an affinity with the genus *Munna*. The typical form of the three posterior pairs of pereopoda are developed into paddle-shaped organs, from which peculiarity the name of the group was given by Sars. But in the progress of his observations he found that others, assimilating to the type in most points, had not the three hinder pairs of legs so developed: hence, in his description of *Macrostyle spinifera*, he writes of these appendages as "Eorum structura ad natandum parum apta esse videtur" (vide *Zoological Record*, 1864, p. 295).

The family is also described as containing animals having no eyes; but we know that subterranean crustacea are generally so, as agreeing with their peculiar habits; but even in these, as far as our experience instructs, the organs are preserved, but reduced to a rudimentary condition. In the nearly-allied genus *Munna*, the eyes are large, and placed at the extremity of a fixed process. But in the other *Asellidæ* the organs are less prominent; and in all other respects we see nothing that can induce us, with the information that we possess, to separate this genus (and we believe also the *Isopoda Remagantia*) from the *Asellidæ*.

ISOPODA.
NORMALIA.

ASELLIDÆ.



LEPTASPIDIA BREVIPES.

Specific character. Cephalon large, semicircular, with a slight depression in the middle of the anterior margin, its posterior lateral angles rounded. First segment of the pereion with the fore margin emarginate, for the reception of the hind part of the head; lateral margins of the segments of the body entire, rounded, and ciliated.

Length, one-twentieth of an inch.

We are only acquainted with a single individual of the single species upon which we have established this genus, the specific characters of which cannot consequently at present be distinguished from the generic ones, and as our specimen was sent to us mounted for the microscope, we have not had sufficient opportunity of observation to allow us to detail the precise structure of the several parts. The antennæ are implanted on the under surface

of the cephalon considerably within the margin. The anterior pair we take to be those that are figured posteriorly in our cut, the basal parts of which are seen through the transparent tissue. These have the joints of the peduncle, which we believe to be of the normal number, surmounted by a slender flagellum consisting of four articuli. The posterior pair of antennæ are much longer, having the joints of the peduncle very long, and terminate in a slender flagellum, consisting of one long and four short articuli.

The anterior pair of legs (first pair of gnathopoda) are moderately robust, and terminate in a hand of considerable prehensile power. All the other legs are slender and tolerably free from hairs. The pleon is pear-shaped, broader anteriorly: on each side, somewhere about two-thirds from the anterior margin, the posterior pair of pleopoda are implanted in the margin, these are fringed with two or three very fine cilia; between this and the anterior margin the edge of the pleon is fringed with a delicate, serrated margin: so transparent is the structure, that it escaped our observation, when we drew the figure, that nine minute teeth were present. On each side of the pereion the hairs are connected together by an exquisitely fine fibrous membrane, that nearly reaches to their extremities.

The animal lives in the mud; two or three specimens have been taken by Mr. Robertson at Cumbræ, to whom we are indebted for it.

ISOPODA.
NORMALIA.

ASELLIDÆ.

Genus—JANIRA. (*Leach.*)

ONISCODA. (*Latreille.*)

Generic character. Pereion serrated along the lateral margins; pleon having all the segments coalesced into a single plate; covered, in the female, beneath with a large, flat membranous plate concealing the branchial feet; and furnished at the tip with a pair of elongated bifid uropoda. Outer antennæ as long as the animal. Dactyla biunguiculate.

THIS genus has hitherto been known only by Leach's short and insufficient characters, which have been reproduced by subsequent authors; it is closely allied to *Jæra* in its general character, but is at once distinguished by the pair of elongated styles at the extremity of the tail, each of which is terminated by a pair of narrow, slender plates, as in the genus *Asellus*.

These styles are liable to be detached at a very slight touch, and hence many specimens of the animal are found destitute of them. They arise in a terminal emargination of the segment, but smaller than in *Jæra*, and having its postero-lateral margin finely serrated. In the males, the large terminal segment is furnished at its base, on the underside, with the male organ, which is narrow, flattened, nearly reaching to the extremity of the segment, and with its tip quadridentate. In the female, this terminal segment is entirely covered with a very thin membranous operculum, concealing the branchial apparatus. The outer antennæ,

in fully developed individuals, are longer than the whole animal. The flagellum is very long, and composed of a vast number of articuli, which are twice as broad as long, each of which appears to consist of three still more minute divisions; the inner antennæ have on the second joint of the peduncle a small pointed articulate scale, the homotype on the large squamiform plate attached to the third joint of the peduncle of the inferior antennæ in the macrourous Decapoda; they are terminated by a slender multiarticulate flagellum, reaching beyond the middle of the long third joint of the outer pair. The fore legs (first pair of gnathopoda) are somewhat more robust than the following limbs, and in this pair the terminal ungues are unequal in size. The parts of the mouth resemble those of *Jæra*, except that in the mandibles we failed to detect the palpiform appendage, which may have been broken off. The labrum is rounded in front, with a deep central incision (fig. *).

We have restored Dr. Leach's name of *Janira* to this genus, which Latreille, with complete disregard to the rules of priority in nomenclature, had changed to *Oniscoda*. The former name was published in the "Edinburgh Encyclopædia," vol. vii., previous to 1814, as Dr. Leach himself, in his "Memoir on the Classification of the Linnæan Insecta," read at the Linnæan Society in the early part of 1814, refers to his article in the "Edinburgh Encyclopædia." In 1826 Risso, finding that the name *Calypso*, which in 1816 he had given to a genus allied to *Galathea*, had already been used by naturalists, proposed that of *Janira* in its stead, in the Errata to his "Natural History of the Crustacea of Nice;" Latreille, however, overlooking the prior employment of the name *Janira* by Leach, rejected that name and proposed that of *Oniscoda* in its stead, in the "Familles Naturelles du

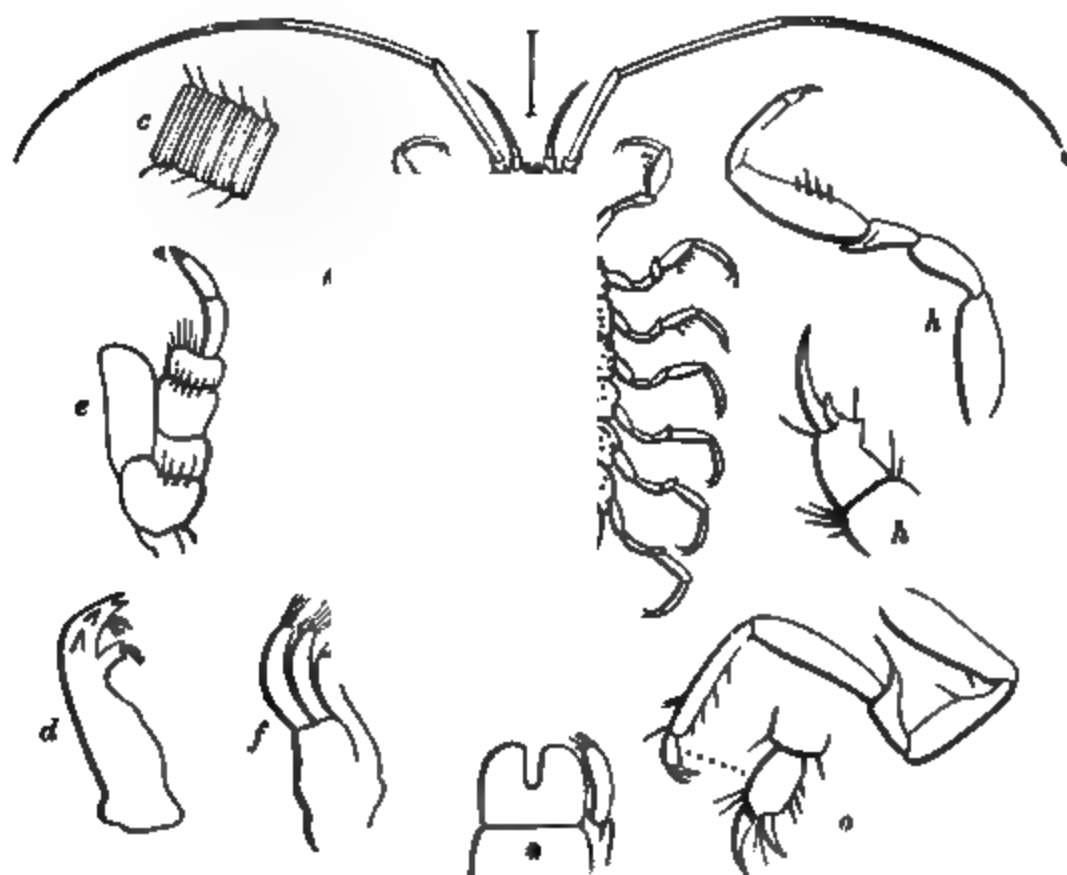
Règne Animal," 1825,* forgetting that he had himself used that latter name for the tribe, of which *Oniscoda* is the type.

* The effect of forgetting that he had himself used the latter name for the tribe of which *Oniscus* is the type, and this restoration of the name *Janira* to Leach's genus will be, that Risso's decapod genus, successively named *Calypso* and *Janira*, will require a third generic name.

NEAR FOLKESTONE.

ISOPODA.
NORMALIA.

ASELLIDÆ.



JANIRA MACULOSA.

Specific character. Ash-coloured, entirely covered with minute dark-brown dots; segments of the pereon finely but irregularly denticulated along the lateral margins. Pleon serrated on the latero-posterior margin. Basal joint of the uropoda as long as the terminal rami, of which the outer one is slightly longer than the inner.

Length, from one-quarter to one-third of an inch.

- Janira maculosa.* LEACH, Edin. Enc. vii. p. 434. Trans. Linn. Soc. xi. p. 373. Suppl. Enc. Brit. i. p. 428. SAMOUËLLE, Ent. Compend. p. 110. WHITE, B. M. Cat. Brit. Crust. p. 70. RATHER, Nov. Acta. ix. p. 24.
- Oniscoda maculosa.* LATREILLE, Règne An. iv. p. 141. MILNE EDWARDS, Crust. iii. p. 151. WHITE, Pop. Hist. Brit. Crust. p. 184, pl. 12, f. 7. GOSSE, Man. Mar. Zool. 1, f. 244.

THE body is flat and oblong, rather than ovate, in form, in consequence of the width of the head and tail. The

segments of the body are transversely channelled near the anterior margin of each, and each segment has its lateral margin marked with small incisions (that vary in specimens), giving a serrated appearance to the animal. The white upper surface is punctured and marked with minute dark-brown dots. The eyes are placed somewhat on the disc of the head, instead of occupying its posterior lateral angles. The two basal joints of the peduncle of the posterior pair of antennæ are short and stout; the third is also short, but much narrower; the fourth and fifth are long and slender, and the whole terminate in a long multiarticulate flagellum. On the second joint of the peduncle is a short, pointed, articulated plate; this is tipped with three hairs.

The first pair of legs are somewhat larger in the male than in the female, and have the carpus short and superiorly produced over the propodos; the propodos is long, narrowly oval, and armed along the inferior margin with two or three short robust spines; the dactylos is as long as the propodos, fringed with minute cilia along the concave margin, which impinges closely in its entire length against the inferior margin of the propodos, and has its extremity furnished with two curved ungues.

The tail consists of a single plate; it is flattened and nearly circular, with the latero-posterior margins finely serrated, the extremity having but a small incision, the terminal styles (which are about equal to the entire tail in length, with the basal joint about as long as the two terminal branches) being affixed beneath the margin of the tail, so that their place of insertion is not seen from above.*

* We believe that the length of the antennæ, and the amount of serration at the sides of the body and tail, vary according to age and sex.

Colonel Montagu's typical specimens in the British Museum have served for our figures of this species. They were taken on the coast of Devonshire; Mr. N. P. Cocks found it in crevices of rocks at Falmouth. We also have it from Polperro, captured by Mr. Couch, from Berwick Bay, taken by the late Dr. G. Johnston; the Rev. W. Norman also obtained it on the Durham coast.

ISOPODA.

ASELLIDÆ.

NORMALIA.

Genus—ASELLUS. (*Geoffray.*)

Generic character. Flagella of all the antennæ multiarticulate, lower pair more than half the length of the body; eyes round and lateral; pereiopoda uniunguiculate; pleon with two long and exserted bifid appendages.

THE species of this genus have the body oblong, rather narrowed towards the head, with eight rather deep lateral incisions between the various segments of the body, which are depressed and slightly irregular on the upper surface, the sides being furnished with strong, irregular lengthened spines. The head is transverse, scarcely narrower than the body, the fore margin nearly straight, the eyes small, round, and quite lateral. The upper antennæ about twice the length of the head, and very slender; the lower antennæ more than half the length of the animal, cylindrical, all the antennæ having a multiarticulate flagellum, which is very long in the lower pair. The segments of the body are nearly of equal size, each being marked with an impressed transverse line near the base. The fore pair of legs are rather short, robust (especially in the males), and terminated by a subcheliferous hand, with apical hook-like finger; the three following pairs of legs are longer, much more slender, and simply ambulatory; and the three hind pairs of legs are gradually longer, all being terminated by a simple acute and curved finger. The tail consists of a large shield-like joint, with indications of two very short joints at

its base, and with its extremity forming two wide but shallow emarginations, within which are affixed two long caudal appendages (or uropoda), composed of an oblong basal joint, supporting two elongated branches. On its under surface the tail bears two opercular plates, divided transversely by an articulation across the middle, which cover the branchial plates, and bear at the base a complex apparatus in both sexes.

The only British species, and two others, natives of North America, occur in fresh-water ponds and lakes.

The following vignette, taken for us by the Rev. J. M. Joass, of Eddestown, is a view of the Blasted Heath of Shakespeare, Forres seen in the distance, taken near a pool from which the Rev. George Gordon has sent us some very large specimens of *Asellus aquaticus*.



THE BLASTED HEATH, FORRES.

ISOPODA.

ASELLIDÆ.

NORMALIA.

ASELLUS AQUATICUS.

Specific character. Upper antennæ reaching to the extremity of the peduncle of the lower; flagellum of the lower twice the length of the peduncle. Persion of a greyish colour, mottled with paler markings; peduncle of the caudal appendages nearly half the length of the slender terminal subequal filaments.

Length of the male, nearly half an inch; female, much smaller.

- | | |
|---------------------------|--|
| <i>Oniscus aquaticus.</i> | LINN. Syst. Nat. ii. p. 1061. ROEMER, Gen. Ins. pl. 80, fig. 12. |
| <i>Cymothoa aquatica.</i> | FABRICIUS, Ent. Syst. ii. p. 505; Ejusd. Suppl. p. 303 (<i>Idotea aq.</i>). |
| <i>L'Aselle.</i> | GEOFFROY, Ins. Paris, ii. p. 672, t. 22, f. 2. |
| <i>Asellus aquaticus.</i> | OLIVIER, Enc. Méth. iv. p. 252. LEACH, Trans. Linn. Soc. xi. p. 373. GÜNTHER MANNVILLE, Icon. B. An. Crust. t. 81, f. 3. SAMOUILLER, Ent. Compend. p. 110. WHITE, B. M. Cat. Brit. Crust. p. 69; Pop. Hist. Brit. Crust. p. 230, pl. 12, f. 6. |

Squilla asellus.

DE GEER, Ins. vii. t. 31, f. 1—20.

*Asellus vulgaris.*LATREILLE, Hist. Nat. Crust. et Ins. vii. p. 359,
t. 58, f. 1. DESMAREST, Cons. Crust. p. 314,
t. 49, f. 1, 2. MILNE EDWARDS, Crust. iii.
p. 146. CUVIER, R. An. (edit. Crochard) t. 70
bis, f. 1.*Entomon hieroglyphicum.* KLIN, Remarq. s. l. Crust. fig. 5.

THIS is a very common animal, occurring in fresh-water ponds and ditches throughout the kingdom. The male is much larger than the female. The head is about half the size of the following segment; its underside is nearly covered by the large outer pair of foot-jaws, which consist of an oblong flattened basal joint (furnished on the outside, at the base, with a large semi-oval plate, Règne An. Ed. Crochard Crust., pl. 70 bis, fig. 1 a, and Treviranus Verm. Schr. t. xi. fig. 59 a, a), and five short terminal joints, of which the first is produced into a lobe at its inner extremity, and the last forms an acute finger-like joint. The mandibles (Treviranus o. c. fig. 63) are armed on the inside with a strong, horny tooth, and on the outside with a three-jointed palpiform appendage. The inner maxillæ are described by the same author (fig. 60) as only having two terminal setose lobes, and the outer (fig. 61) as formed of two lobes, the inner one much more slender than the outer. The bilobed labium (fig. 62 z) lying between the base of the mandibles, is described by Treviranus as the third pair of maxillæ.

The ventral surface of the segments of the body, in the males, is marked with strong transverse corrugations; in the female, it bears the large ovigerous sac, within which the young are developed. The male, as is well shown by Treviranus o. c. fig. 65 p. and 66 z, is furnished with a pair of small and narrow curved horny lobes in the middle of the hinder segment of the body,

on its underside, followed by a pair of small crustaceous sac-like appendages, constricted (*ib.* fig. 67 p. and De Geer, vii. pl. 31, fig. 12 e, e), which partially conceal a bipartite, complex, horny apparatus, each portion consisting of a large basal joint (partly visible in the upper part of our figure, P), which supports two small knob-like appendages, the innermost of which is armed with a small horny spur, directed backwards (De Geer, fig. 13 x, and Treviranus, fig. 67). This apparatus was first very carefully described and figured in detail by De Geer, and subsequently more satisfactorily by Treviranus. In the female, this apparatus is replaced by two small semi-oval plates, strongly ciliated along the terminal outer edge, which rest upon the base of the outer pair of branchial plates, the latter being divided into two nearly equal portions, as in the male.

The following excellent account of the habits of this animal is given by Sir J. Dalryell, in his fine work on the "Powers of the Creator":—

"The species abounds in remarkable profusion in a pond at Red Braes, in the immediate vicinity of Edinburgh. None exceed six lines in length, and little more than half a line in breadth. It feeds upon vegetable matter exclusively. The leaves of the beech in decay are preferred, and in such parts of the pond as these are most abundant, there the *Asellus* is most numerous. The animal does not generally swim, it runs freely and expeditiously over the decaying leaves.

"The breeding season extends through several months of the year. The ovarian pouch occupies the under surface of the thorax and abdomen, and contains about forty ova. Many of the young, very minute and almost white, recently hatched, were running about over and under the leaves on the 22nd May. The young animal

is about half a line long, and transparent under the microscope.

“The young in one instance were observed to be hatched during the week previous to the 22nd July, but in one year each of these specimens had a cluster of white ova on the thorax in the middle of September.

“The posterior extremity of the young is proportionably more obtuse than in the parent. Further, unless it be immediately or speedily consequent on production from the ova, they do not seem to undergo any conspicuous metamorphosis.

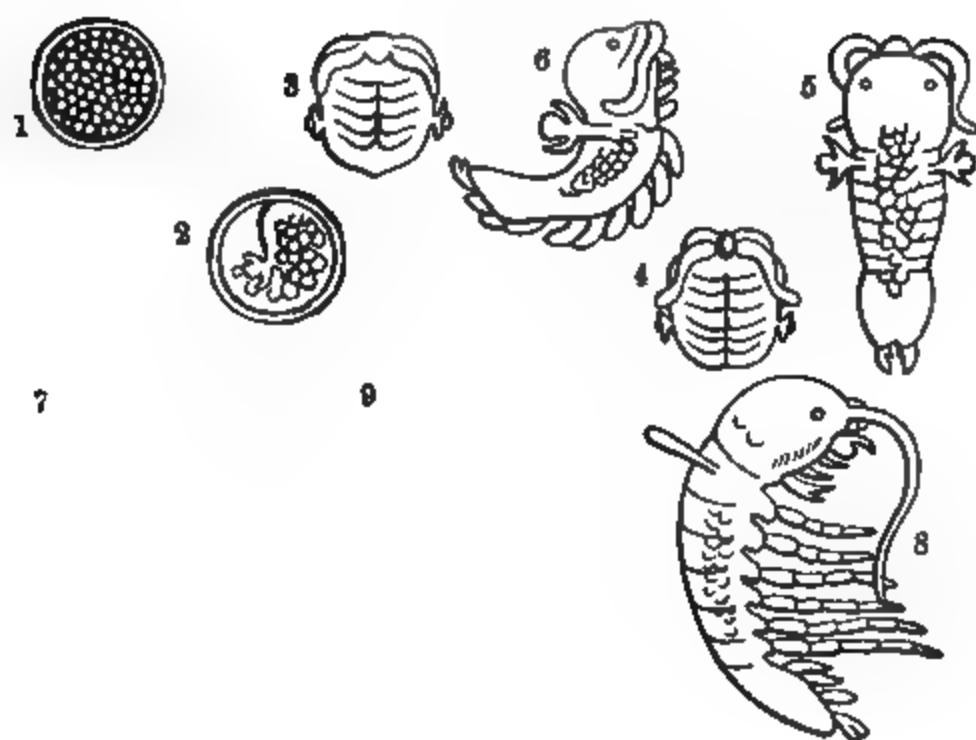
“Exuviation is less frequent here than in many other crustaceans. The integument, however, separates in two portions, which are nearly white.

“This is an extremely pacific, tranquil creature, always seeking shelter. Specimens have survived many months when kept in confinement.”

The development of the eggs and young of this species has been carefully investigated by De Geer, in his great work on Insects, and more recently, in greater detail, by Rathke,* from whose elaborate series of illustrations the accompanying figures have been selected.

The eggs having been discharged from the oviduct, are entirely destitute of any trace of germ, and are retained and hidden beneath the four pairs of large, slender, and semi-transparent scales attached to the under surface of the body of the female, where the young are disclosed, and remain until they have assumed a form similar to that of their parents. Our first figure represents the egg in its early state, filled with the yolk and enclosed in a thin chorion.

* Abhandlungen zur bildungs und entwickelungs Geschichte des menschen und der Thiere. Leipzig, 1832, 4to, Erster Theil, p. 3 tab. 1. Translated in Annales Sci. Nat., 2 sér. Zool. tom. 2.



EMBRYONIC DEVELOPMENT OF ASELLUS AQUATICUS.

In figure 2, the egg is further advanced, showing the molecules of the head, and one of the external lateral appendages. In figure 3, the embryo is seen in front, showing the rudiments of the two pairs of antennæ, labrum, five pairs of mouth-organs, and the two lateral external appendages. Figure 4 shows the embryo a little more advanced, and figures 5 and 6 the same, with the body stretched out and seen dorsally and laterally, exhibiting the eyes, segments of the body and tail, the latter figure representing the antennæ thrown backwards laterally, and the rudimental legs. At this period the enclosed animal does not exhibit the slightest voluntary or involuntary movements, and Rathke consequently regards the *Asellus* as emerging from the egg in a more imperfect state than any other articulated or vertebrated animal. At figures 7

and 8, the embryo is now nearly arrived at its full development, the legs exhibiting traces of articulation, and the lateral appendages having lost their trilobed appearance; the mandibles, two pairs of maxillæ, foot-jaws, and branchial plates, and the terminal appendages of the tail are visible in figure 8; lastly, in figure 9, the embryo is seen in its final stage, with the large lateral antennæ articulated, and the lateral appendages entirely lost. In figures 6 and 9 it will be observed that there are only six leg-bearing segments, and six rudimental pairs of legs, whilst there are seven segments and as many pairs of legs in the fully developed animal; Rathke affirming that "le dernier de ces anneaux et sa paire de pattes ne se forment qu'en peu de tems après la sortie du jeune de la cavité incubatoire" of the mother; he, however, asserts that the wanting seventh segment is produced by the division into two parts of the sixth segment before the first moulting of the animal, but admits that the formation of this last pair of legs "m'est restée assez obscure," partly because it is effected very rapidly, and partly because the other legs, being long, cover all the hind parts of the body.*

We have ourselves examined the earliest stages of these animals, and our observations agree with those of Rathke, except that in the early embryonic condition the lateral appendages appeared to us to be entire, with a rounded terminal knob, instead of being tripartite, and that in the state corresponding with that of our lower right-hand figure, the upper pair of antennæ are free, as in figure 9, and that the external sac-like appendages were associated with the hepatic lobes.

* This circumstance is of considerable importance, viewed in connection with the question of the number of legs in the early stages of *Entoniscus* and *Cryptothiria* (*Liriope*).

ISOPODA.

ASELLIDÆ.

NORMALIA.

Genus—LIMNORIA. (*Leach.*)

Generic character. Oblong-ovate, depressed; antennæ subequal, cylindrical, not longer than the cephalon. Pereiopoda nearly alike, slender. Pleon six-jointed. Branchial plates naked. Terminal segment large, semicircular, with a lateral appendage on each side bearing two terminal slender styles.

THE small animal which forms the type of this genus is oblong, rounded in front and behind, and subdepressed. The head is short and round, with the eyes wide apart, composed of but few facets. The antennæ are of nearly equal length, being scarcely longer than the head, and terminated by a bristly pencil of hairs, the upper pair composed of three small joints and a small ex-articulate flagellum, and the lower pair also composed of three joints, with a small articulated flagellum. The outer foot-jaws consist of a long basal joint, closely united to the following, the inner apical angle of which is considerably dilated, produced and setose; the four following joints are also short, with their inner angles similarly produced. At the base is attached an elongated triangular plate; this plate is developed to its fullest extent in the *Idoteidæ*. The mandibles are elongated, flattened, horny, broadly truncated at the extremity, and furnished with a triarticulate palpiform appendage. The first pair of maxillæ consist of two very delicate elongated plates, the inner one being the more slender and curved; both are setose at the tip, but the inner has, moreover, a strong curved spine at its inner extremity. The second pair of

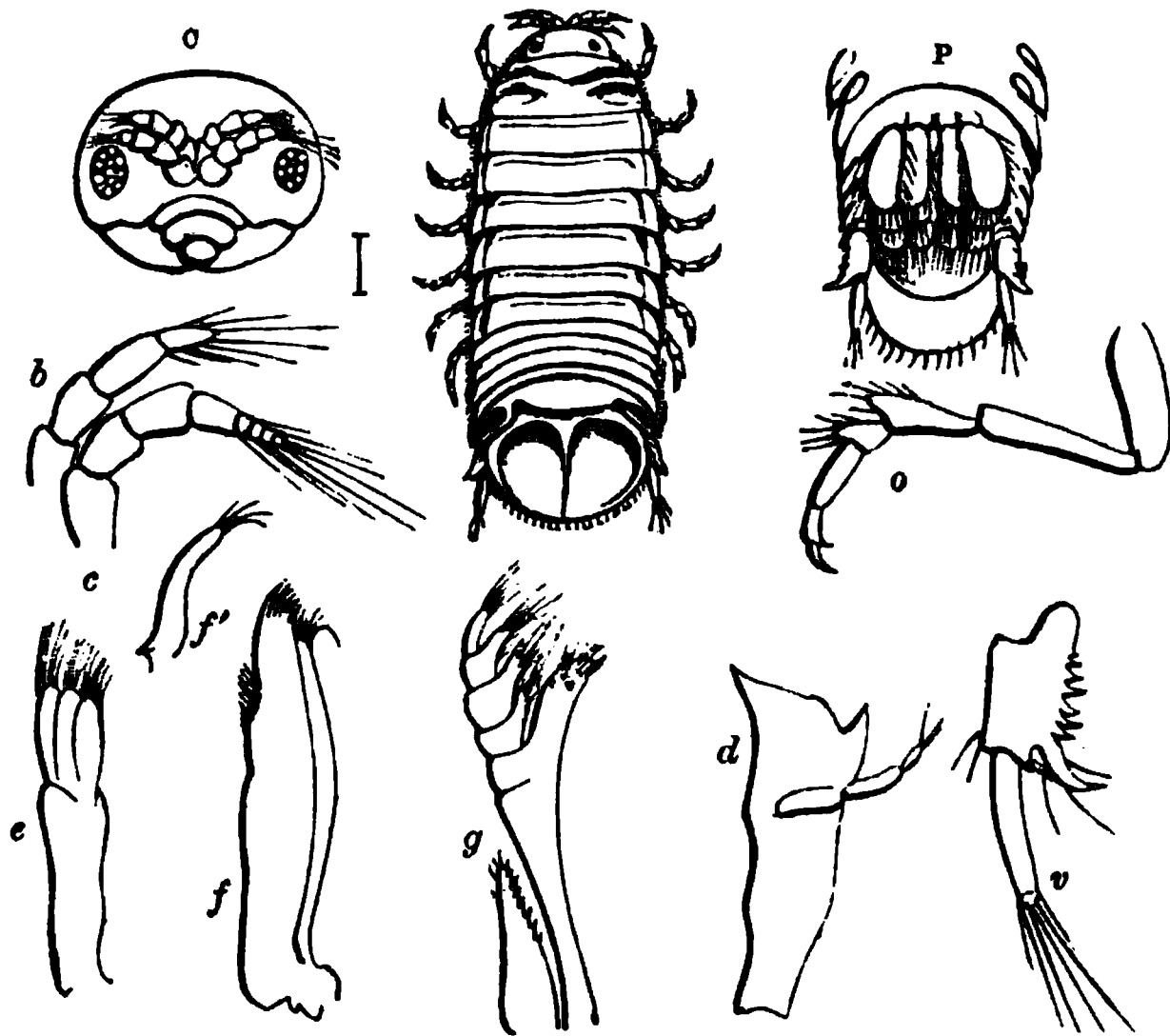
maxillæ are also very delicate, furnished with three oblong-ovate terminal plates, setose at their extremities. The legs are short and slender, all being formed nearly alike, the four anterior ones being, however, rather more robust and tuberculated on the basal joints, all terminating with a small slender curved finger. The tail consists of six segments, of which the four basal ones are short and equal, with the posterior margin entire; the fifth has the posterior margin irregular, and the sixth is large, semicircular, flattened, with a slight central ridge; on each side it bears a lateral appendage, of which the basal portion is nearly square, with the outer margin notched, and terminating in a strong, curved, movable spine; the apical portion forms a slender style, with strong bristles at its extremity, which appears to be separated into a minute articulation. The ovigerous pouch of the female consists of four pairs of scales, affixed to the middle segments of the body, and the tail is furnished on its underside with six pairs of scale-like, branchial plates, forming three rows, which are naked and of equal size. These plates are received, as in the *Sphæromidæ*, in a cavity formed by the excavation of the underside of the caudal segments. In this respect, and especially in the segmentation of the pleon, the genus is removed from the remainder of the *Asellidæ*; indeed, Dr. Leach formed it into a distinct race in his great family *Cymothoadæ*, which also included the *Serolidæ*, *Ægidæ*, and *Sphæromidæ*.

The whole of the dorsal surface is covered with stiff, pinnated hairs, amongst which numerous minute parasites, somewhat like *Echinorhynchi* and *Acari*, are constantly to be seen. They even infest the branchiæ.

ISOPODA.

ASELLIDÆ.

NORMALIA.



LIMNORIA LIGNORUM (THE GRIBBLE).

Specific character. Entirely covered with small, setose hairs. Lower antennæ not longer than the head. Terminal segment of the tail entire, rounded, and flattened, with a slight central dorsal carina, and the lateral margins raised.

Length, about a line and a half.

Cymothoa lignorum. RATHKE, Skrivt af Naturh. Selsk, vol. 101, t. 3, f. 14 (1799).

Limnoria lignorum. WHITE, Pop. Hist. Brit. Crust. p. 227, pl. 12, f. 5.

Limnoria terebrans. LEACH, Dict. d. Sci. Nat. art. Cymothoadées, Edinb. Enc. vii. p. 433. Trans. Linn. Soc. xi. p. 371. Suppl. Enc. Brit. 1, 428. DESMAREST, Cons. Crust. p. 312. SAMOUELLE, Ent. Compend. p. 109. COLDSTREAM, in Edinb. New Phil. Journ. xvi.* p. 316, t. 6, f. 1—16. HOPE, Trans. Ent. Soc. Lond. 1, p. 119. W. THOMPSON, Edinb. New Phil. Journ. xviii. p. 127. MILNE EDWARDS, Crust. iii. p. 145. WHITE, B. M. Cat. Brit. Crust. p. 68. GOSSE, Man. Mar. Zool. 1, fig. 242. WESTWOOD, in Gardener's Chronicle, 1849, p. 388, fig. annexed.

* This and the preceding plate are erroneously lettered "vol. xvii."

THE GRIBBLE is one of the most destructive creatures to be found amongst the whole of the articulated animals, burrowing into the wood of marine erections, such as piers, piles, and other works of public utility. Being the only known species contained in the genus, its leading characters have been detailed above, and in the generic description. The male is about one-third larger than the female. In general, not more than seven, or at most nine, young ones are found within the incubatory pouch. When the animal is alive, it contracts itself almost into a ball, thus confirming the relationship of the genus to the *Sphæromidæ*. They are able to live at least a fortnight within the wood, taken out of the water and placed in a dry room. Each of the eyes is composed of seven or eight blackish facets, one being in the centre. The legs are articulated just beneath the sloping lateral margins of the body, and being partly folded beneath the pereion, a small portion only of each is seen when the animal is in motion. The longest are the first and fifth pairs; the legs of the second segment are shorter and thicker than those of the first, the third and fourth pairs being similar to the second; the fifth pair is more slender, and the sixth and seventh pairs resemble the fifth, but are rather smaller. The terminal finger is, in all the legs, single and somewhat hooked.

Dr. Coldstream describes a peculiar organ situated within the cavity of the tail, behind the branchiæ, consisting of two vesicular bodies of an oval form, attached to a common peduncle. They were always found filled with numerous dark-coloured granules, of an irregularly round shape, which could not be detached from the substance in which they were embedded by tearing it up. They exist in both males and females. The animal creeps but very slowly, backwards as well as forwards, appearing

to drag itself along. It turns rapidly, using chiefly the caudal plates, which it uses as oars; sometimes also it propels itself by a sudden movement of the tail, backwards, to the distance of an inch or more, through the water.

It appears that, notwithstanding the extent and importance of its ravages upon structures, affecting the interests of mankind in a very extensive manner, it was not noticed until about the year 1811, when Dr. Leach announced it, as a new and highly interesting species, sent to him by Robert Stevenson, Esq., the celebrated engineer, and as occurring in the greatest abundance at the Bell Rock lighthouse on the Scotch coast, erected by that gentleman, burrowing into the old woodwork, which it perforated in a most alarming manner, entering into it to the depth of several inches by boring in every direction, generally in straight lines, avoiding, however, the knots of the timber, round which it works.

Many kinds of wood, including old oak, are devoured by the *Limnoria*, although it was generally found in other timbers, especially Memel fir. Mr. Stevenson saw it attack oak, black-birch, and other woods; indeed, teak was the only wood exposed to its ravages which was not perforated. Its mode of attack is very similar to that of the common *Anobium* in the timber of houses, &c., which is so often mistaken for dry rot, the chief difference being that the action of the waves wash away the outer and harder annual layers, in consequence of all the soft intervening spaces being eaten away, whilst the inner ones, as well as the knots of the branches, stand out in relief—consequently the surface of the wood soon becomes gradually rotten and reduced in its dimensions.

It is by means of its mandibles that it forms its burrows in the wood, which evidently forms its support,

as the stomach is found filled with minute ligneous particles. The burrows are about one-fifteenth of an inch in diameter; they are cylindrical, and perfectly smooth on the inside.

We must refer the reader to Dr. Coldstream's valuable memoir (from which most of the preceding details of the habits of the species have been derived) for an account of the injuries committed by these little depredators in various parts of the Scottish coast; as well as to Mr. Thompson's memoir, in the 18th Volume of the "Edinburgh New Philosophical Journal," where numerous Irish localities are recorded, and to Mr. Albany Hancock's memoir in the "Newcastle Naturalists' Transactions." Mr. Hope's suggestions in the "Transactions of the Entomological Society," vol. i. p. 119 and xxxiv., must also be referred to for their practical character. It was observed by Mr. Spence, at Bridlington Bay, near Hull, and Dr. Moore stated in "Charlesworth's Magazine of Natural History," that its injurious effects had been observed for forty years in Plymouth Harbour.

Through the kindness of the superintendent, Admiral Drummond, we have recently had the opportunity of examining into the extent of the depredations of this little creature on the submerged timber in the Royal Dockyard at Devonport.

It is the opinion of Mr. Moore, the able and intelligent master shipwright, who has had the opportunity of observation extending over thirty years, that the ravages of the *gribble* in this dockyard is considerably less than it was at the early part of his career.

But this appeared to us to be more the result of successful attempts in the great care and ability shown in protecting the timber from the action of the animal, than in the decrease of this creature in the locality.

The means taken to protect the woodwork are of several descriptions, viz., copper sheathing; iron nails closely studded; (the ferruginous oxide that the action of sea-water produces, impregnates the wood, and forms a protective iron crust all over the surface;) creosote and coal-tar are likewise used, and it is the opinion of Mr. Moore that all timber that can be smeared over once a year, is effectually freed from the ravages of the *Limnoria*.

The action of these animals is more or less rapid, according to circumstances. Pinewood they appear to destroy about the rate of one-quarter to half an inch in a year: of course this must be less rapid during the first year or so, and more rapid after several years, for the numerical increase of animal life must be greater in proportion to time. We find that that portion of the pine framework that supports the hull of the *Robust* frigate, that was commenced being built on the 31st of October, 1859, and is submerged at every tide, has been eaten in many places from two to three inches, while an inspection of the pine scaffolding round the half-built fort just within the Plymouth breakwater and harbour, erected between three and four years, shows us that the extent of the depredation amounts to from three-fourths of an inch to an inch and a half, according to the nature of the wood and its freedom from any protecting influence. The little animals invariably choose the softer places, shunning the knots and hard lines of wood that longitudinally connect one knot with another. They likewise avoid every part of the wood that had been impregnated with iron, sometimes for several inches round the place where a nail or bolt had been driven.

Oak they attack not so readily as pine, but still the former gradually falls before their persevering action, the

softer or more sappy portion disappearing more rapidly than the more solid parts. Thus it would appear that it is necessary that all timber must be somewhat softened by the water before they commence their depredations.

We have been indebted to Mr. H. Pownall for specimens of the injured timber, and individuals from the Southampton Water, extending to woodworks a mile up the Itchen river. It appears to be very general all round our coast. It is abundant in the river Dee, and the piles supporting the rock lighthouses at New Brighton are drilled by them. The late Mr. W. P. Cocks found them also in wood cast on shore at Falmouth, and the Rev. A. M. Norman has sent it us from the Shetlands.

ISOPODA LIBERATICA.—Sub-tribe II.

THE animals comprising the second sub-tribe of the *Isopoda Liberatica* (which is equivalent with the family *Idoteides* of M. Milne Edwards) differ from the general form of the order in the greater elongation and parallelism of the body, which is more or less abruptly truncated at each extremity. In the most extreme forms the body is quite cylindrical, resembling that of the larvæ of certain Lepidopterous insects (*Geometra*), even in its peculiar movements and position when at rest. The eyes are large and lateral, the anterior pair of antennæ are very short, and inserted above the posterior pair, which are considerably—occasionally very much—elongated. The mandibles are short, robust, and horny, with a strong denticulated apical incurved tooth, below which, on the inner margin, is a smaller denticulated and movable tooth: these organs are destitute of a palpiiform appendage. The outer foot-jaws have the second joint produced into an elongated plate, ciliated at the tip with a hook in the middle of its interior margin; the four terminal joints are variable in size, the fourth in *Idotea* being large and oval, whilst it is very small in *Arcturus*. The legs vary both in size and arrangement, the four anterior pairs in *Arcturus* being very slender, ciliated, and directed forwards, whilst the three posterior pairs are short and very robust, and directed backwards; whilst in *Idotea* the legs are nearly of equal size and character, the three anterior pairs being directed forwards, and the four

posterior pairs backwards. In none of the groups are the fore legs terminated by a didactyle claw. The principal character of the tribe consists, however, in the structure of the tail and its appendages. This part of the body consists of one large caudal shield, destitute of lateral appendages, of which one or more of the anterior segments exhibit evidences of being more or less imperfectly soldered together, whilst the branchial plates are arranged in five pairs, entirely closed over by the outer, that is, the first or anterior pair of pleopoda, which shut together like the two divisions of a cupboard door, and which plates have a transverse division near the extremity.

The British genera included in this tribe constitute two families, *Arcturidæ* and *Idoteidæ*, well distinguished by the structure of their legs, which has induced Mr. Dana to remove *Arcturus* from this division of the order, and arrange it among his *Anisopoda*, a mode of distribution which appears to us unnatural.

Mr. Dana has, moreover, established an additional family in the sub-tribe, under the name of *Chætilidæ*, for the reception of a Patagonian species, *Chætilia ovata*, nine lines long, remarkable for having the sixth pair of legs twice as long as the entire animal, terminating in a very long bristle-like extremity, which consists of numerous joints: the seventh pair has also a multiarticulate extremity, which is, however, quite short.

Family—ARCTURIDÆ.

THIS family, corresponding with the tribe *Idoteides Arpenteuses* of M. Milne Edwards, is composed of the single genus *Arcturus*, of Latreille, remarkable amongst the *Isopoda* for its slender, cylindrical form, the length of its lower pair of antennæ, and the delicate ciliated structure of the four anterior pairs of legs; whilst the hind ones are short and very robust. In the British species, the fourth segment of the body is greatly elongated, and as the animals affix themselves by means of their hind pairs of legs, elevating the front part of the body, and twisting it about in various directions, they exhibit considerable resemblance to the *Caprellæ*, as also to the loopers, or Geometrical Caterpillars of the *Geometræ*, whilst the elongated antennæ give them also a strong resemblance to the Amphipodans, constituting the genus *Corophium* (vol. i p. 493); in fact it is by the assistance of the great antennæ that these creatures chiefly progress, their fore legs being too delicate to serve as instruments of locomotion.

The species of the group found in the Arctic seas are of very large size, sometimes reaching three inches in the length of their bodies. This is the case with the type of the genus *Idotea Baffini*, Sabine, first described in the appendix to Captain Parry's fourth voyage. This species has the fourth joint of the body not much longer than the adjoining segments, and if it should be considered necessary to separate the British species, as form-

ing a distinct genus or subgenus, it will be necessary to employ for them another name, in which case that of *Leacia*, proposed in 1825 in honour of Dr. Leach, by Dr. G. Johnston, must be used instead of *Arcturus*, a step, however, which we by no means considered necessary and advisable.

Mr. Goodsir, who carefully studied the animals of this group, was not acquainted with the characteristics of the male sex in the *Arcturi*, almost all the specimens which he procured having eggs in the marsupium. The eggs are pear-shaped and curved, and have a tough external membrane, with a granular white and a light yellow mass towards their centre, which may be of the nature of yelk globules. The ovaries are two elongated white granular bodies on each side and beneath the liver: they open at the third segment of the body, at the extremity of the marsupium.

ISOPODA.

NORMALIA.

ARCTURIDÆ.

Genus—ARCTURUS. (*Latreille.*)

Leacia. JOHNSTON, Edinb. Phil. Journ. xiii. 219 (1825). WESTWOOD
(subg.).

Astacilla. FLEMING.

Leachia. MILNE EDWARDS (subg.). H. GOODSIR.

THE chief characters of this genus have been already detailed in our observations on the family, whilst those of the British species, as forming a distinct subgenus from the Arctic type, *A. Baffini*, are characterized by the great elongation of the fourth segment of the body (which we believe varies somewhat in degree according to the sexes), and which, joined to the more slender form of the animals, allow a much greater freedom of movement to the front part of their bodies, enabling them to hunt for their prey round a fixed spot without moving from it. The eyes are large, semi-globose, and lateral, with the anterior-lateral angles of the head produced in a forward direction. The upper pair of antennæ are very short, and terminate in an obtuse-pointed, uni-jointed flagellum, whilst the lower pair are very long, sometimes longer than the entire body, and terminated, in the typical species, by a multiarticulated flagellum; but in the British species the flagellum consists of only three joints, closely united together, deflexed and incurved, the terminal joint at the tip being formed so as to make a strong point by which, when fixed in an advanced position, the animal is able to pull itself forward.

The anterior pair of legs, although partaking of the

character of the three following pairs, are considerably shorter and broader, and being more closely applied to the mouth, they appear to represent a second pair of maxillipeds, so that the animals may almost be regarded as exhibiting the anomalous condition of having two pairs of foot jaws and six pairs of legs, instead of one pair of the former and seven of the latter, as in the ordinary *Edriophthalma*, or three pairs of the former and five of the latter, as in the *Decapoda*.

It is in such anomalous groups as these that we see the advantage, in a scientific point of view, of the identification of each part by a name that is homologically true, instead of *varying the term* with the *variation of form* or use that the necessities of animals require. If we adopted the latter plan, as is too frequently the case even among some of the best carcinologists, we should be obliged to name the four anterior pairs of legs in this genus as four pairs of maxillipeds, and which, added to the pair which is homologically consistent, would make five pairs, which would be a manifest absurdity.

The genus was established by Latreille in the second edition of the "Règne Animal," published in 1829 (having been indicated by name only in the "Familles Naturelles," published in 1825), for the reception of *Idotea Baffini*.* In 1834, Professor Westwood communicated a memoir, with figures, on the genus, which he regarded as osculant between the normal *Isopoda* and the *Læmodipoda* of Latreille, to the Entomological Society of London. (Transactions, vol. i. p. 69.) He divided the genus into two sections (subsequently adopted by M.

* Latreille gave the species under the undescribed name of *A. tuberculatus*, not recognizing its identity with *I. Baffini*. Even now it is only by conjecture, or by the synonyms given by M. Milne Edwards, that we are able to identify the animal intended by Latreille.

Milne Edwards): 1. *Arcturus* Proper, containing *Idotea Baffini*, and 2. *Leacia*, Johnston, containing *Oniscus longicornis*, Sowerby (to which Dr. Johnston, regarding it as undescribed both generically and specifically, had given the name of *Leacia lacertosa*). Mr. H. Goodsir, however, considered the two sections as of generic rank, and accordingly retained the name *Leachia* for the British species. Until recently, a single British species has only been recognized. The late lamented Harry D. S. Goodsir, Surg., R.N., however, detected two other species, of which he published descriptions and figures in the 31st volume of the "Edinburgh New Philosophical Journal." Living specimens of all these three species were captured by Mr. Goodsir with the dredge in deep water in the Frith of Forth, and in the German Ocean, but all these were found to be rare in consequence of their pelagic habitat. Having kept these animals in glass jars of sea-water, with sand and coral-lines, Mr. Goodsir was enabled to watch their habits closely. Under these circumstances each individual will select a branch of coralline, keeping that branch exclusively to itself, and defending it with the greatest vigour against all intruders. It fixes itself to its resting-place by means of its true feet, which it seldom uses for progression. When it falls to the bottom of the vessel, it fixes its long-pointed antennæ into the sand, and with the assistance of the true feet drags and pushes itself forward. This, however, may not be a natural mode of progression, but may be adopted in consequence of the artificial circumstances in which the animal is placed. The ordinary and natural mode of progression of these animals is swimming. It is amusing to see one of these animals resting in an erect posture, on a branch of coral-line, by means of its true feet, waving its body back-

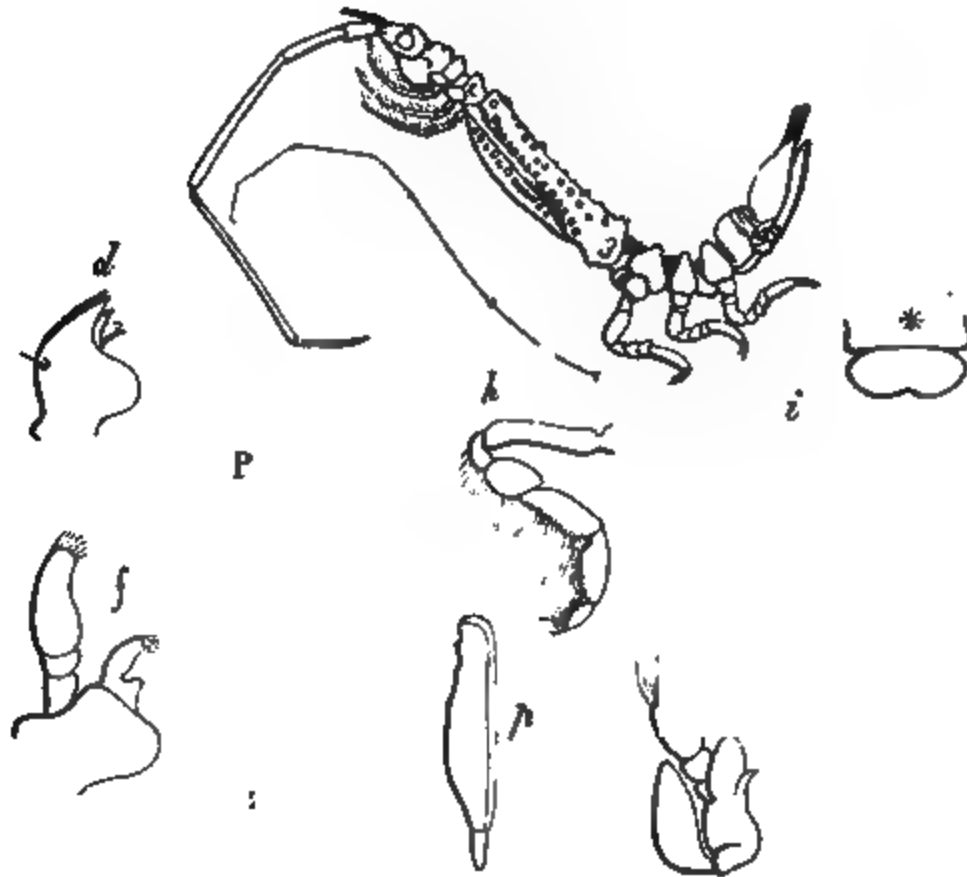
wards and forwards, throwing about its long, inferior antennæ, and ever and anon drawing them through its anterior fringed feet, for the purpose of cleaning them. It frequently darts from its branch with the rapidity of lightning, to seize with its long antennæ some minute crustaceous animal, and returns to its resting-place to devour its prey at pleasure. In this manner the antennæ are the only organs employed in seizing and enclosing the prey, which they drag to the anterior feet, which hold it while it is being devoured. The strong claws with which the inferior antennæ are armed, seem also to be useful to the animal in the act of prehension, and in an Antarctic species we find this power increased by the presence of strong teeth.

The formation of the fourth segment of the body, together with the antennæ (especially the upper pair) and the peculiar sculpturation of the surface, afford the best specific characters, and will doubtless sufficiently separate the three species described by Mr. Goodsir from any others that may occur.

Mr. Goodsir gives a series of details of the internal anatomy of these animals, the nervous system consisting of a supra-œsophageal ganglion, from which the nerves of sense proceed, followed by four ganglions, united by double cords, at the base of the four ciliated pairs of legs, with three similar ganglia at the basis of the three posterior pairs of feet, united to the preceding by a long double cord. Two highly developed and distinctly defined longitudinal muscles stretch along the dorsal aspect of the elongated fourth thoracic segment, their office being to enable the animals to erect the anterior part of the body on the true formed legs, and affording a purchase for the proper action of the powerful clawed antennæ.

ISOPODA.
NORMALIA.

ARCTURIDÆ.



ARCTURUS LONGICORNIS.

Specific character. Moderately slender. Four anterior segments of the body strongly tuberculated. Upper antennæ reaching to the tip of the second joint of the inferior. Flagellum longer than the two preceding joints together. Second, third, and fourth segments dilated over the place of insertion of the legs.

Length of the body, one inch.

Oniscus longicornis. BOWERBY, Brit. Misc. t. 19.

Arcturus longicornis. WESTWOOD, in Trans. Ent. Soc. Lond. 1, 72, t. 16.
GUÉRIN MÉNÉV. Icon. R. An. Crust. t. 31, f. 2.
MILNE EDWARDS, Crust. iii. p. 124. WHITE, Cat.
Brit. Crust. Brit. Mus. p. 63. Pop. Hist. Brit.
Crust. p. 221, pl. xii. f. 1. GOODE, Man. Mar.
Zool. 1, fig. 249.

Astacilla longicornis. FLEMING, Edin. Enc. vii. p. 502. JOHNSTON, in London's Mag. Nat. Hist. viii. p. 494, f. 44, adult;
ix. p. 80, f. 15, young. DALYELL, Powers of
Creator, 1, p. 226, pl. lxiii. figs. 1—4.

Leachia lacertosa. JOHNSTON, Edinb. Phil. Journ. xiii. p. 220.

THIS species is more robust than either of the two following; it is also more strongly tuberculated, the tubercles extending over the two segments preceding the long one, which is somewhat transversely furrowed. The head and terminal segments of the body are rather broader in the male, but of an equal breadth throughout in the opposite sex; the females are twice the size of their partners, and of a whitish colour; the terminal portions of the body are generally directed upwards. The head is almost square, with the eyes prominent and nearly circular: the anterior angles of the head are produced in front of the eyes, forming a deep frontal emargination, in which the anterior (upper) antennæ are inserted; these are not longer than the head, and have the basal joint large, the next row short, and the flagellum long, cylindric, and terminated by setæ. The lower antennæ are nearly as long as the body, and very robust; the first joint is very short, the second rather longer, with a deep external notch, the third about as long as the head; the two next are very long, each being about one-fourth of the whole length of the body; the flagellum is very short and finely serrated beneath, each being gradually smaller, the last terminated by a minute acute point; the antennæ are usually carried in a downward direction. The parts of the mouth are very minute and delicate. The lip is transverse, rounded at the sides and emarginate in front. The mandibles are small, horny, broad, and armed with several teeth, without any palpi-form appendage. The interior pair of maxillæ are very thin, transparent, and deeply ciliated. The second pair of these organs are larger, with a terminal lobe and a large external sub-articulated appendage, the last division of which is much larger than the rest, curved and ciliated at the tip.

The first three segments of the pereion are very short, with a produced lateral margin (representing the coxæ, or first joint of the legs, and) concealing the base of the legs, the first pair of which are alike in form, but shorter than the others, and evidently perform the office of an extra pair of foot-jaws; indeed, from the manner in which this, as well as the three following pairs of feet, are carried over the mouth, it is probable that they are all employed rather as such than as locomotive organs. The very slender structure of these three pairs of legs, which are all formed alike and are strongly ciliated within, is also confirmatory of this opinion. The first pair of legs are also ciliated, the ciliæ arising in double rows, and being often bearded, as is also the case with the three following pairs, in which, however, only two of the hairs situated near the extremity of the penultimate joint are thus bearded.

The fourth segment of the body is very long, occupying more than one-third of the whole length of the animal, and being perfectly cylindrical in the males, in which sex it is without any orifice or inferior lamellæ, and is the narrowest part of the body; but in the female it is as wide as the head, and furnished beneath with two thin membranous plates, lapping over each other, and serving as an envelope for the eggs, which are of a red colour and kidney-shaped. The fourth pair of legs are attached below the anterior angles of this segment. The three succeeding segments are short, rounded at the sides, and respectively furnished with a pair of strong short legs, well formed for prehension, having the last joint terminated by a bifid hook. These legs are not ciliated, and have a backward direction.

The tail, seen laterally, appears to consist of only two segments, of which the first is almost globose, and the second oval, terminating in a strong spine; seen from

above, the first of these segments appears divided into two, the posterior lateral angles being produced into distinct pointed lobes: there is also a much less distinct impression across the middle at the lower sides. The terminal segment, also, has each side produced in the middle into an acute angle, behind which the apex is gradually acuminate.

The first segment of the tail is furnished beneath with a pair of long thin plates, articulated to this and the following joint at the outer edge, and which are capable of shutting and opening like a pair of cupboard doors. Each of them is terminated by a slender acuminate process. On opening this pair of organs a most beautiful apparatus is exhibited, consisting of no less than twenty distinct pieces, arranged in five double pairs, serving for respiration. At the base (in the male at least) is also a pair of minute organs, terminated by two somewhat cultrate plates. The first double pair of the respiratory plates (which cover all the rest) succeed these appendages, and are composed of a rather long and bent flat foot-stalk, having on the outside four curiously bent ciliated spines, and terminated by two long, delicate, membranous, equal-sized plates, slightly scalloped at the extremity for the insertion of the ciliæ, which are very long and beautifully bearded; the base of the internal plate is also furnished on the outside with several long bearded spines. The second double pair of plates are nearly similar to the preceding, except that one of the plates is very much narrowed. The three succeeding double pairs of plates are much smaller and shorter, each consisting of a pair of oval membranous plates, almost destitute of ciliæ, attached to a short basal foot-stalk.

Detailed representations of most of the organs above described will be found in the first volume of the "Trans-

actions of the Entomological Society," plate ix., drawn from specimens communicated by the late Dr. Johnston, by whom they were captured in Berwick Bay. The specimens figured by Sowerby were caught by Mr. T. W. Simmons, entangled in nets, off Dysart, near Inchkeith. The species was also captured by Mr. H. Goodsir in the Frith of Forth, and in deep water in the German Ocean, occurring more frequently than the two following species; also by Dr. Clarke, off Cullercoats, on the Northumberland coast: a colony of young animals was taken, attaching themselves to the spines of *Echinus sphaerus*, in the Channel, off Plymouth, by ourselves (Dublin Nat. Hist. Rev., October, 1857, p. 229).

Sir J. G. Dalyell, who kept some of these animals for some time alive, gives the following particulars of their habits and movements. "Its peculiar organization gives it a most unusual appearance, during repose grasping the slenderest twig with its six hind feet, while all the body is bent back beyond the point of fixture, so that the creature actually seems broken-backed.

"Its motions are very singular, aggravated perhaps by the apparently extraordinary proportions of the various parts. The position, frequently assumed and long retained, is adhering by the hind legs to any foreign substance, with the head downwards." Sir J. Dalyell "never saw any specimen attempt to swim, to which, indeed, its general form is quite adverse to the supposition. The exuviation of a specimen took place during the first week of October, when the shell was detached in two portions, the posterior comprehending the six hind legs.

"The season of propagation extends from March to December. Ova appeared on June 14th, [beneath the

pereion of] a female specimen. But the presence of a diminutive white zoophyte injured the roe, which proved abortive of progeny. A full-grown specimen was placed in a suitable vessel on the 21st of March; on the following day above sixty young were observed in the vessel: all were pure white; they exceeded a line in length, their black eyes were rather oval, and they resembled their parent in general.

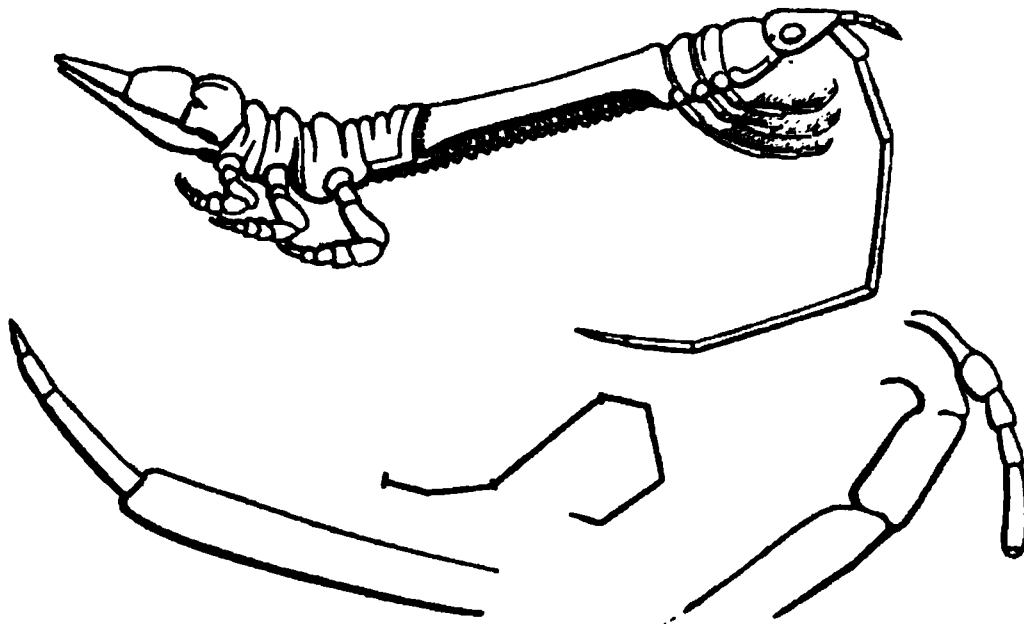
“On the 21st of May the appearance of another individual attracted Sir J. Dalyell’s notice; it stood erect on a piece of sponge, the body at right angles to the six hind feet. The long antennæ now stretched forward, as usual with the species, but each appeared as thick or thicker than the animal itself, and on a transient glance it seemed invested by a coating of fur; however, this unaccountable fact was easily explained by the application of a lens. A numerous brood had been produced in the night, whereof the whole, without exception, had seated themselves on the antennæ: yet the parent neither testified impatience of their presence nor seemed to suffer any uneasiness under the burden. All were very pale or dingy white, none of them exceeding a line in length. The young grew very rapidly; but as they continued affixing themselves, they certainly proved an annoyance which was ultimately fatal.”*

The animal dwells in the deep sea. Fine specimens are rare.

* A specimen of *A. Baffini* is preserved in the collection of the British Museum, in which the young are attached to the antennæ of the parent. We think, therefore, that we may assume that this mode of conveying their young may be a peculiar feature in the instinctive habits of this animal. (See vignette in p. 374.)

ISOPODA.
NORMALIA.

ARCTURIDÆ.



ARCTURUS INTERMEDIUS.

Specific character. Upper antennæ longer than the two basal joints of the lower; the flagellum minute and obtuse; the fourth segment of the body with a double row of small tubercles on each side of both the longitudinal hinges of the ventral marsupial pouch, or ovigerous scale.

Length, four lines and a half.

Leachia intermedia. H. GOODSIR, Edinb. New Phil. Journ. xxxi. p. 309, pl. 6, f. 1. WHITE, Cat. Brit. Crust. p. 64. Pop. Hist. Brit. Crust. p. 222 (*Arcturus int.*).

THE characters of this species were first pointed out by the late lamented Harry D. T. Goodsir. It resembles *A. longicornis*, but the peculiar prominent parts of that species are more boldly thrown out. The plates on each side of the base of the antennæ do not project, and their infero-anterior angles are acute. The superior antennæ are longer than the first two joints of the inferior; the first joint is globose, the second and third are slender, and the flagellum is obtuse. The inferior antennæ are almost as long as the body; the first joint is as long as the head, cylindrical, and having a ridge on its external side; the following joints are more slender, and the last joint of the flagellum is finely pointed.

A double row of tubercles run down each side of the inferior margin of the body, immediately above the insertion of the legs; these tubercles are large and very prominent on the three anterior and three posterior segments of the body, but on the fourth they are not so prominent, and are placed in a regular series on each side of the longitudinal hinges peculiar to this segment in the female.

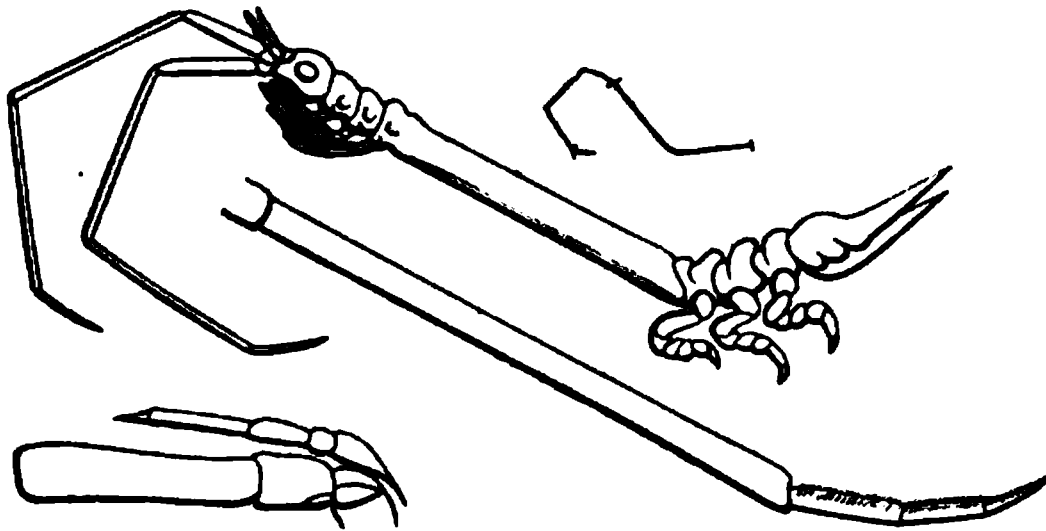
The pleon bulges considerably, and then tapers suddenly to a point at its posterior extremity.

The animal is of a straw colour, spotted with brown.

Not having seen a specimen of this species, we have been compelled to borrow our description and figures from Mr. H. Goodsir's Memoir on the genus above referred to. It was taken in the Frith of Forth, opposite Anstruther, by Mr. H. Goodsir.

ISOPODA.
NORMALIA.

ARCTURIDÆ.



ARCTURUS GRACILIS.

Specific character. Very slender, quite smooth, and destitute of tubercles; the upper antennæ rather shorter than the first three joints of the lower; the fourth segment of the body linear-cylindric, and not tubercled.

Length, seven lines.

Leachia gracilis. H. GOODSIR, Edinb. New Phil. Journ. xxxi. p. 310, pl. 6, f. 4.

Arcturus gr. WHITE, Cat. Brit. Crust. p. 64. Pop. Hist. Brit. Crust. p. 222.

IN this species the body is very slender and quite smooth, without the tubercles, which are found in all the other species. The plate which covers the base of the antennæ projects, and is rounded anteriorly. The superior antennæ are almost as long as the first three joints of the inferior, the first joint being globular, the second and third linear, each as long as the first; the flagellum is equal in length, or longer, than the peduncle, and the last articulation is minute and linear. The inferior antennæ are as long as the body, with the first joint obsolete, the second slightly clavate, and the flagellum strongly pectinated on their inferior edges. Both pairs of antennæ have a few bristles scattered over them. The body is quite smooth, except a few scattered punctures. The fourth segment is linear, cylindrical, and not

tuberculated. The anterior segments of the pleon bulge very much, assuming the appearance of one of the segments of the pereion, and from this it tapers very gradually to a very sharp point.

The colour is rusty white, with brown spots.

Taken by Mr. Goodsir in the Frith of Forth, off Anstruther.

Our figure is taken from one of Mr. Goodsir's type-specimens preserved in the British Museum.

Family—IDOTEIDÆ.

THIS family, which contains the largest known Isopoda, some of which are above four inches in length, is distinguished by the long, narrow form of the animals, by the subequal segments of the pereion, by the fusion of three or more of the segments of the pleon into one large caudal shield, by the absence of uropoda or external caudal appendages, by the conversion of the fifth pair of pleopoda into a continuous operculum for the protection of the branchial organs, by the nearly uniform size and structure of the seven pairs of legs, and by the shortness of the superior pair of antennæ, which never exceed the length of the cephalon. Some interesting exotic genera of this family have been described by Mr. Dana, in his great work on the American Exploring Expedition.

ISOPODA.

NORMALIA.

ARCTURIDÆ.

Genus—IDOTEA. (*Fabricius.*)

Generic character. Lower antennæ with four thickened cylindrical basal joints of moderate length, followed by a long multi-articulate flagellum; first pair of legs not larger than the second. Pleon with two basal joints distinct, followed by a third semi-distinct. The four posterior ones fused into one common caudal plate.

THIS genus (to which, with Professor Milne Edwards, we refer the *Stenosomæ* and *Siduriæ* of Leach, and the *Lep-tosomæ*, *Hebe*, *Oliskæ*, *Zenobiæ*, and *Armidæ* of Risso) comprises an extensive series of species having the body more or less flattened and elongate, the head broadly truncate in front, the eyes small, lateral, and multifaceted. The upper pair of antennæ shorter than the head, and very slender, composed of four joints, of which the fourth is flattened, curved, and about the length of the preceding joint, but having the appearance of being composed of several articulations closely soldered together; the lower pair of antennæ rarely exceed half the length of the body, and are composed of five strong basal joints, with a long, slender, multiarticulate flagellum. The parts of the mouth are protected in front by a large crustaceous lip (labrum), and behind by the large pair of foot-jaws, each of which consists of a strong basal stem, with an elongated lobe at its inner extremity (bearing a small style-like appendage on the middle of its inner edge), and with three large terminal joints, strongly ciliated along their inner margin and at

the tip. At the base of each of the foot-jaws is attached a large movable sub-oval plate. The mandibles are robust, with a strong, curved, denticulated apical blade, below which is a small movable plate, and a broad truncated molar tubercle: they are destitute of an articulated palpiform appendage.

The outer maxillæ are very delicate, and terminated by three oblong strongly ciliated plates; the inner maxillæ have an elongated base and two thin terminal lobes of unequal size, ciliated at the tips: the lower lip is thin, with a deep incision in the middle of its anterior margin (fig. * in page 379).

The legs are all formed for walking, rather than for prehension or swimming; they are nearly of uniform structure, the anterior pair being not larger than the following; they, however, increase gradually in length to the hind pair. In the female, the third and three following pairs of legs bear at the base of each a large membranous plate, folded beneath the body, forming a large ovigerous sac. The tail consists of a very large terminal flattened shield, preceded by three very short segments, of which the third is dorsally fused with the next succeeding. In *I. Entomon*, a Baltic species, there are three distinct and two apparent joints in this part of the body; in other species, the soldering together more or less completely of two or more of the short basal joints takes place, until in *I. appendiculata* the tail appears to consist of only a single large plate-like shield, traces of the articulations being only visible at the lateral margins of the basal portion of the joint.* The normal six-jointed structure of the tail is, on the contrary, proved on the ventral surface of the

* The variations in the condition of these basal segments have furnished Professor Milne Edwards with the characters for distributing the species into various minor groups.

animal by the existence of five pairs of very delicate branchial appendages (each appendage bears two plates), and a strong outer pair (which are the terminal uropoda), forming an operculum, opening laterally and shutting over the branchial apparatus.

M. Polydore Roux, in his fine work on the Crustacea of the Mediterranean, gives some interesting details of the habits of these animals, which abound in places where the sea has brought together masses of *Algæ* in a state of decomposition; here, at the depth of a foot or two in tranquil water, they multiply rapidly, feeding voraciously on dead fishes, mollusks, annelids, and other animal matters, gnawing also the meshes of nets of fishermen. They are essentially nocturnal, avoiding the light of day by hiding themselves under marine plants, but never under stones, and coming forth to feed after dark, sometimes in such vast numbers as, in company with small Paguri, shrimps, &c., to consume a large amount of the fish caught in nets. They crawl with facility at the bottom of the sea, and swim easily by agitating the plates of the tail. When the sea is rough, they seek deep water, and are often thrown back by the action of the waves. They are much used by fishermen in the Mediterranean as baits for different species of *Psarus*, *Perca*, &c., which take them greedily, their capture being distinguished in Provence under the name of *Pesquo à la baboué*, the latter being the name applied to these animals as well as the parasitical *Cymothoæ*. This is done by tying together bundles of *Fucus ericoides*, which are sunk into the sea, and quickly adopted by the *Idoteæ* as new places of retreat, and which at certain intervals are drawn up, and the *Idoteæ*, as well as great numbers of *Talitrus*, called *Mourpuros*, *Sphæromæ*, and other Isopods, shaken out.

ISOPODA.
NORMALIA.

IDOTEIDÆ.



IDOTEA TRICUSPIDATA.

Specific character. Elongate-subovate; lower antennae nearly half the length of the animal. Segments of the pereion (except the first) with distinct coxal plates (epimeræ) occupying the whole lateral margin. Pleon with the first and second segments distinct, the third soldered in the middle to the terminal large joint, which is more or less tridentate at the tip.

Length of the body, about one inch and a third.

- Idotea tricuspidata.* DESMARET, Cons. Crust. p. 289 (and pl. 46, f. 11?).
ROUX, Crust. Médit. t. 29, f. 11, 12. MILNE
EDWARDS, Crust. iii. p. 129. WHITE, B. M. Cat.
Brit. Crust. p. 65. Pop. Hist. Brit. Crust.
p. 223, pl. 12, f. 2. GOSSE, Man. Mar. Zool. 1,
fig. 247.
- Oniscus trident.* SCOPOLI, Ent. Carniolica. OLIVIER, Enc. Méth. vi.
p. 26.
- Idotea Entomon.* PENNANT, Brit. Zool. 4, pl. 18, f. 5. LEACH, Linn.
Trans. xi. p. 364.

- Idotea Basteri.* AUDOUIN, Descr. of SAVIGNY, Egypt. Crust. pl. 12, f. 6. ROUX, Crust. Mediterr. t. 29, f. 1—10.
Idotea tridentata. LATREILLE, Con. Crust. et Ins. 1, p. 64. LAMARCK, H. Anim. s. Vert. 5, p. 269.
Idotea variegata. ROUX, Crust. Mediterr. pl. 30, fig. 1—9.
Armida bimarginata. RISso, H. n. Eur. merid. 5, 109.

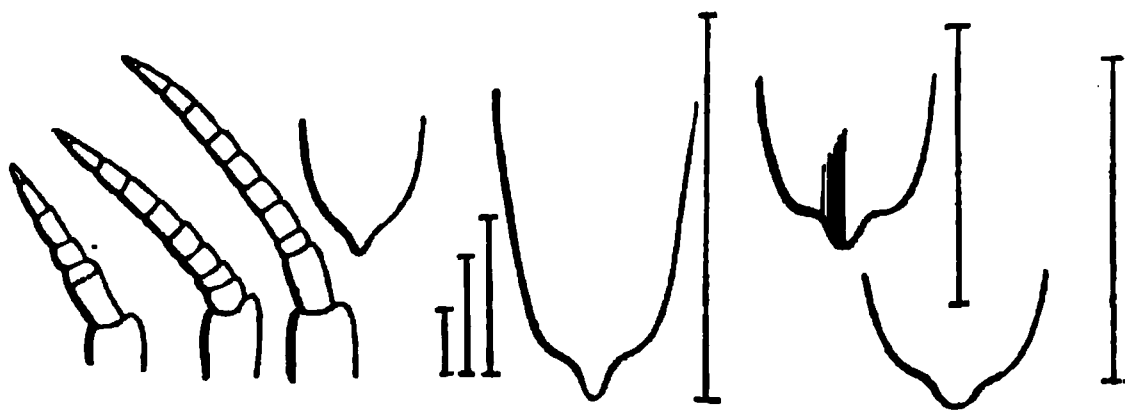
THIS large species has the body of a very elongate-oval form, slightly narrowed towards the extremity of the tail, which is terminated by a strong central point, having a smaller one on either side, which is, however, often wanting, and the lateral angles rounded.

The lower antennæ are nearly half the length of the entire animal, the first joint very short and scarcely visible from above; the four following joints gradually increase in length, but decrease in thickness, and the flagellum, which is rather longer than the five-jointed peduncle, is slender, and consists of about twenty articulations. The first segment of the body has the coxal plate fused at the sides, but the six following have it separated by a curved incision (indicating the epimeral or basal joint of the legs), and which is more angulated in the middle on the three posterior segments. The anterior segment of the tail in the male is armed beneath with two short horny points, directed backwards, and the second pair of the branchial plates is also furnished, in this sex (at least), with an elongated style, nearly as long as the plates.

The tail consists, apparently, of four segments, of which the first and second are quite distinct, although very short, but the third loses all trace of articulation in the middle of the back, so as to appear completely soldered with the large terminal joint.

This species varies greatly in its colours and markings; generally, it is of a dirty greenish-grey, but often has a pale longitudinal line down the middle of the back, or

on each side of the body, whilst other specimens are marked, often irregularly, with large pale yellow or orange-coloured patches on the body and tail. According to our own experience, the colour of the animal is dependent upon that of the weed on which it lives. Those that live on the black fucus are generally very dark purple, while those that we find on the green *Algæ* are brightly verdant; and it has always been our opinion that this change was due to the food, as we have little doubt but that they are vegetarians in diet, and that the depredations on fish is that of their marine companions.



The accompanying woodcut exhibits different varieties, showing the comparative paucity of the articulations in the flagellum of the lower antennæ in young individuals, the length of the three individuals whose antennæ are delineated being indicated by the three adjoining lines, whilst the other figures exhibit variations in the form of the terminal segment of the body, with the length and size of the respective specimens in the British Museum, the first, third, and fourth of which are from Cornwall (B. M. Coll. No. 50, 94, and 45, 139), and the large second one from Cardiff (No. 56, 73). Some very fine specimens taken off Cornwall have the caudal extremity terminating in three well-defined cusps, as also one sent to us by Mr. Gosse from Torquay.

Specimens having the extremity of the tail truncate,

with the lateral angles scarcely prominent, and the middle tooth only very slightly developed, have been considered as distinct species by M. Polydore Roux, who has carefully figured a number of varieties; those marked with pale spots being his *I. variegata*, and the unicolorous ones his *I. Basteri*. We agree with Professor Milne Edwards in considering them as mere varieties.

Specimens of this species from the Cornwall and Devonshire coasts, as well as from Scotland, are contained in the collection of the British Museum. The largest specimens we have seen (measuring one inch and five lines and an inch and a quarter long) were forwarded to us, the former by Mr. Byerley from the Cheshire coast, the latter was taken off the Dudman, on the coast of Cornwall. There are also numerous specimens from different Irish localities in the Belfast Museum, collected by the late Mr. W. Thompson, Professor Allman, Mr. Hyndman, Dr. Drummond, and Mr. Patterson; Co. Cork, Mr. Humphreys, "Contributions to Fauna of Co. Cork."

Sir J. G. Dalyell has described and figured some varieties of this species in his "Powers of Creation," vol. i. p. 228, pl. lxiii. fig. 5—9 and 10, under the names of "*Oniscus balthicus (Idotea marina)*," and *Entomon*. "Full-grown specimens measure, from the tips of the antennæ to the posterior extremity, twenty-one lines in length. Their colour is dingy or brownish-yellow, with three or four white specks down the centre of the back; or it is altogether of variegated hues, and some are mottled. The variegated specimens are beautiful animals, especially when first appearing in their new shells." He observes that "this creature feeds voraciously, seizing and carrying off prey in its fore limbs. It also devours

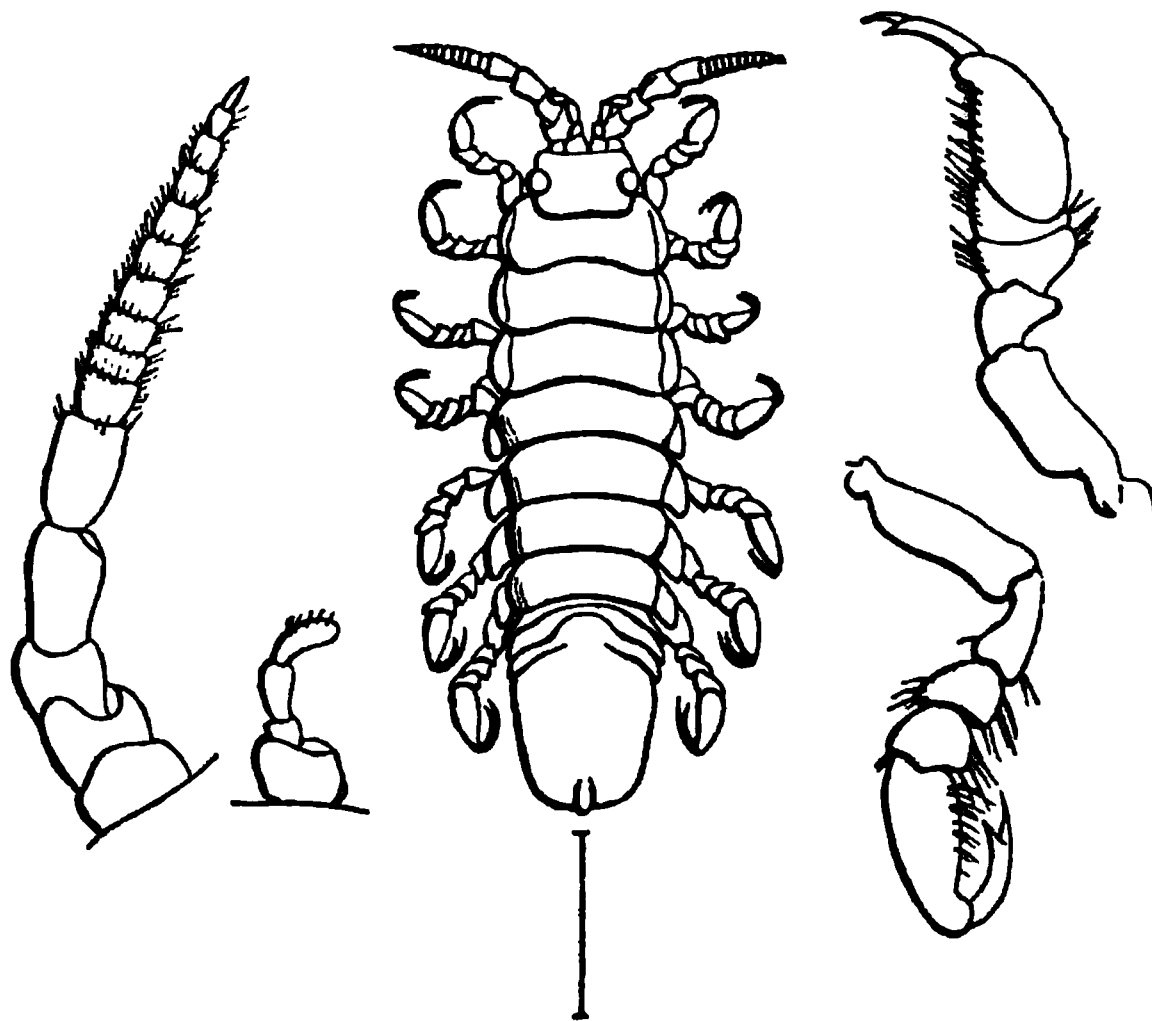
the smaller crustacea and mussels very readily. It swims swiftly, and when at rest it generally clings to some substance admitting of its supine position ; exuviation ensues at different seasons, the shell being always cast in two portions."

Mr. Robertson says that, like the herring, they are observed to grow to a larger size in Loch Fyne than on the neighbouring sea-coast.

ISOPODA.

NORMALIA.

IDOTEIDÆ.



IDOTEA PELAGICA.

Specific character. Front of the cephalon slightly notched; lower antennæ about one-third of the length of the animal, which is narrow, but with the middle segments rather widest. Pleon with the first two joints distinct, the third with the sides only distinct, united with the fourth in the middle; fourth joint large, with a slight keel down the middle, rounded at its extremity, with a small blunt tooth in the middle.

Length, half an inch.

Idotea pelagica. LEACH, Trans. Linn. Soc. xi. p. 365. Suppl. Enc. Brit. i. 426. DESMAREST, Cons. Crust. p. 289. SAMUELLE, Ent. Comp. p. 106. MILNE EDWARDS, Crust. iii. p. 129. WHITE, B. M. Cat. Brit. Crust. p. 65. Pop. Hist. Brit. Crust. p. 223.

Idotea marina. FABRICIUS, Ent. Syst. Suppl. p. 303?

Oniscus balthicus. PALLAS, Spic. Zool. ix. t. 4, f. 6?

Rhætia pelagica. LEACH, MSS.

OUR figures of this species are drawn from Dr. Leach's largest typical specimen in the British Museum Collec-

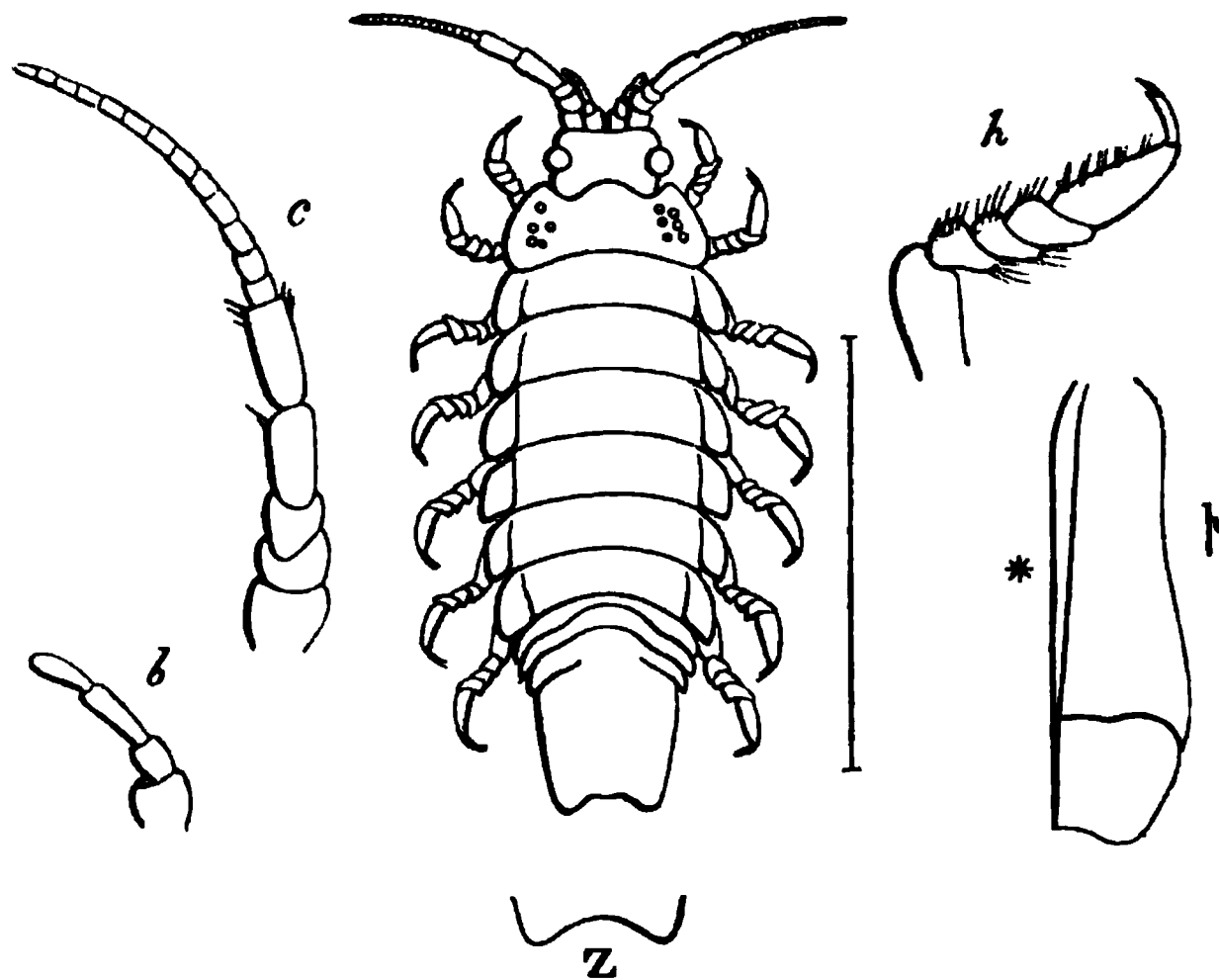
tion (No. 607A). It is certainly very closely allied to *I. tricuspidata*. The body is covered with minute dots; the lower antennæ are about one-fourth of the entire length of the animal; the sides of the segments of the body have the epimeral or coxal articulations as in *I. tricuspidata*, and the basal segments of the tail are articulated in the same manner as in that species, the union between the third and fourth segments at the sides being, however, more decided than in *I. tricuspidata*. The slight central keel at the end of this segment appears to be the most important character.

Common on the Bell Rock in the Frith of Forth. There are also specimens in the British Museum communicated by Col. Montagu. Specimens occur in Mr. Thompson's Irish Collection, taken at Belfast Bay in March, 1841, one about a sixth of an inch in length, as well as another, a quarter of an inch long, from the stomach of a sheldrake, shot at the end of December, also in Belfast Bay. It is also contained in Humphrey's "Contributions to the Fauna of the Co. Cork," and we have received it from the Eddystone Lighthouse. It is probably common all round the coast in the laminarian zone.

ISOPODA.

NORMALIA.

IDOTEIDÆ.



IDOTEA EMARGINATA.

Specific character. Elongate-ovate, sub-convex, finely dotted. Front of head slightly emarginate. Anterior lateral angles rounded. Coxæ of the six hind pairs of legs strongly developed on the dorsal side of the body. Pleon with the third segment confluent in the middle with the fourth, which has the two posterior-lateral angles produced, the space between them emarginate. Lower antennæ nearly one-third of the length of the animal.

Length, one inch and one-sixth.

Cymothoa emarginata. FABRICIUS, Ent. Syst. ii. p. 508.

Idotea emarginata. FABRICIUS, Ent. Syst. Suppl. p. 303. MILNE EDWARDS, Crust. iii. p. 130. CUVIER, Règne Anim. (Ed. Crochard), t. 69, f. 2. WHITE, B. M. Cat. Brit. Crust. p. 65. Pop. Hist. Brit. Crust. p. 224. RISSO, Crust. de Nice, p. 135.

(?) *Squilla marina.*

DE GEER, Ins. vii. p. 522, t. 32, f. 11, 14.

Idotea excisa.

BOSC, Crust. ii. p. 181. LATREILLE, Hist. Nat. Crust. et Ins. vi. t. 58, fig. 5. Var. (?)

Idotea peloponesiaca.

ROM. Crust. Med. t. 30, f. 10.

Idotea æstrum.

PENNANT, Brit. Zool. 4, pl. 18, f. 6. LEACH, Trans. Linn. Soc. xi. p. 565. DESMAREST, Crust. p. 289.

Our figures of this species are derived from Dr. Leach's largest specimen, preserved in the British Museum (No. 1,000). It is very closely allied to *I. tricuspidata*, the chief difference being that the central point of the extremity of the tail (of which a very slight trace may be observed in certain individuals) does not extend so far back as the prolonged lateral angles, and the epimeral scales (coxæ) of the six hind pairs of legs are widely developed on the dorsal surface of the body, which is covered with minute dark-coloured dots.

The basal segments of the tail are also formed as in *I. tricuspidata*, but the lower pair of antennæ are comparatively shorter.

Various specimens, captured in different parts of the British coast by Col. Montagu and Dr. Leach, are contained in the British Museum.

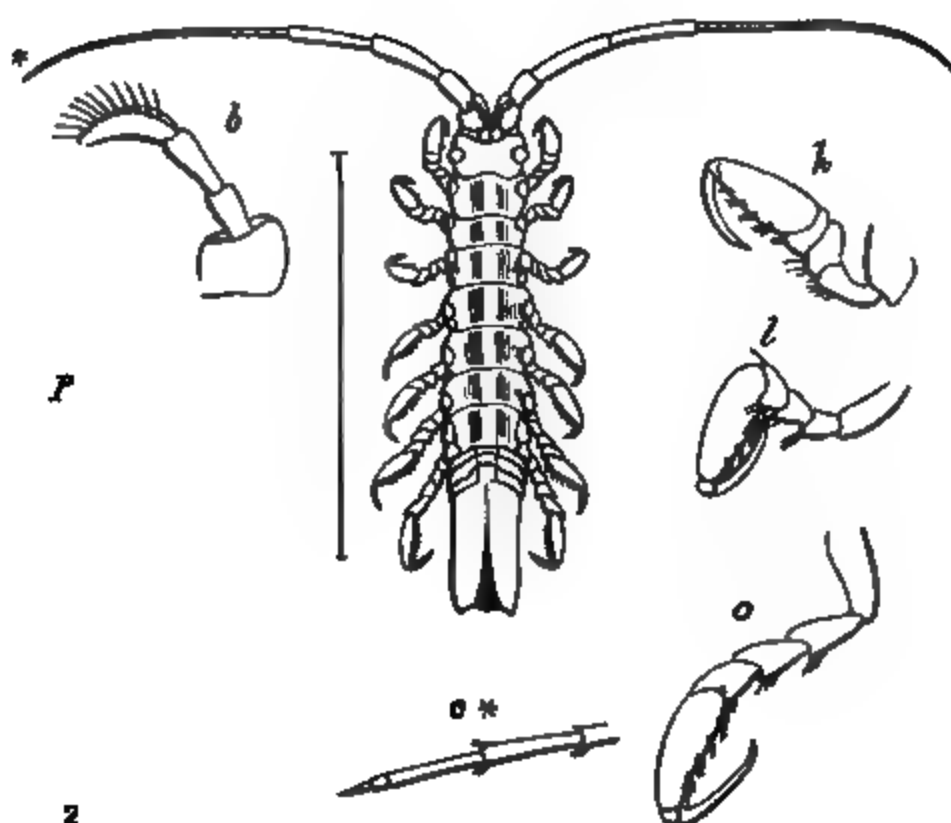
Mr. Robertson has sent it to us from Cumbray, and the Rev. A. M. Norman from the coasts of Durham and Northumberland.

It has also been taken at Port Patrick and Dundrum, Ireland, by the late Mr. W. Thompson. Mr. W. P. Cocks found this species among trawl refuse of fishing boats, also in the stomach of fish at Falmouth. It is common among weeds all round the coasts of Europe.

ISOPODA.

NORMALIA.

IDOTEIDÆ.



IDOTEA LINEARIS.

Specific character. Long, narrow, with the sides of the segments nearly parallel; lower antennæ nearly as long as the animal; joints of the peduncle very robust; pleon with the terminal joint truncated, and tridentate at the extremity, the lateral angles being more prominent than the central tooth.

Length, one inch and a half.

Oniscus linearis.

PENNAANT, Brit. Zool. (edit. 1777), iv. t. 18, f. 2.

Stenosoma lineare.

LEACH, Linn. Trans. xi. p. 366. Suppl. Enc. Brit. i, 427. DESMAREST, Cons. Crust. p. 290, t. 46, f. 12. GUÉRIN MÉNÉVILLE, Exped. Morée, p. 49. SAMOUELLE, Ent. Comp. p. 107.

Idotea linearis.

LATREILLE, Hist. Nat. Crust. et Ins. vi. p. 371. MILNE EDWARDS, Crust. iii. p. 182. Règne An. (Ed. Crochard), Crust. pl. 69, f. 3. WHITE, B. M. Cat. Brit. Crust. p. 66. Pop. Hist. Brit. Crust. p. 224.

Oniscus entomon.

BAXTER, Opusc. Suba. ii. t. 18, f. 2.

(?) *Squilla marina.*

DE GERB, Ins. vii. t. 82, f. 11.

| | |
|----------------------------|---|
| <i>Idotea diodon.</i> | LATREILLE, Nouv. Dict. d'Hist. Nat. xvi. p. 105. GUÉRIN MÉN., Exp. Morée, p. 49. |
| <i>Idotea viridissima.</i> | RISSO, Crust. de Nice, p. 136, pl. 3, fig. 8. |
| <i>Idotea hectica.</i> | LEACH, Edinb. Enc. vi. p. 404. |
| <i>Stenosoma hecticum.</i> | LEACH, Linn. Trans. vii. p. 488. |
| <i>Oniscus unguatus.</i> | PALLAS, Spic. Zool. 9, 62, tab. 4, f. 11 (<i>antennis falsis</i> ?) |

THIS large species is at once distinguished by its parallel and sub-depressed form, and the very robust joints of the peduncular portion of the lower antennæ, which organs are nearly as long as the whole body; the flagellum terminated by two very minute articuli (c. x.); the front margin of the head is strongly sinuated, with the lateral lobes elevated; the upper surface of the whole animal is uneven. The second, third, and fourth segments of the body exhibit a small portion of the epimera-like base of the legs at their anterior angles, whilst the fifth, sixth, and seventh joints have the posterior angles cut off, and replaced by the same portion of the legs. The first two segments of the tail are quite distinct, but the third is only separated from the large terminal segment at the sides, being completely soldered with it in the middle; the legs gradually but slightly increase in length, from the first to the seventh pair, each being armed with a long and strong simple hook-like finger. The tail occupies one-third of the entire length of the animal.

The operculum reaches to the posterior margin of the caudal segment, and has the second joint narrower than the first, and terminating in a rounded extremity.

This species occurs in many parts of the British coast.

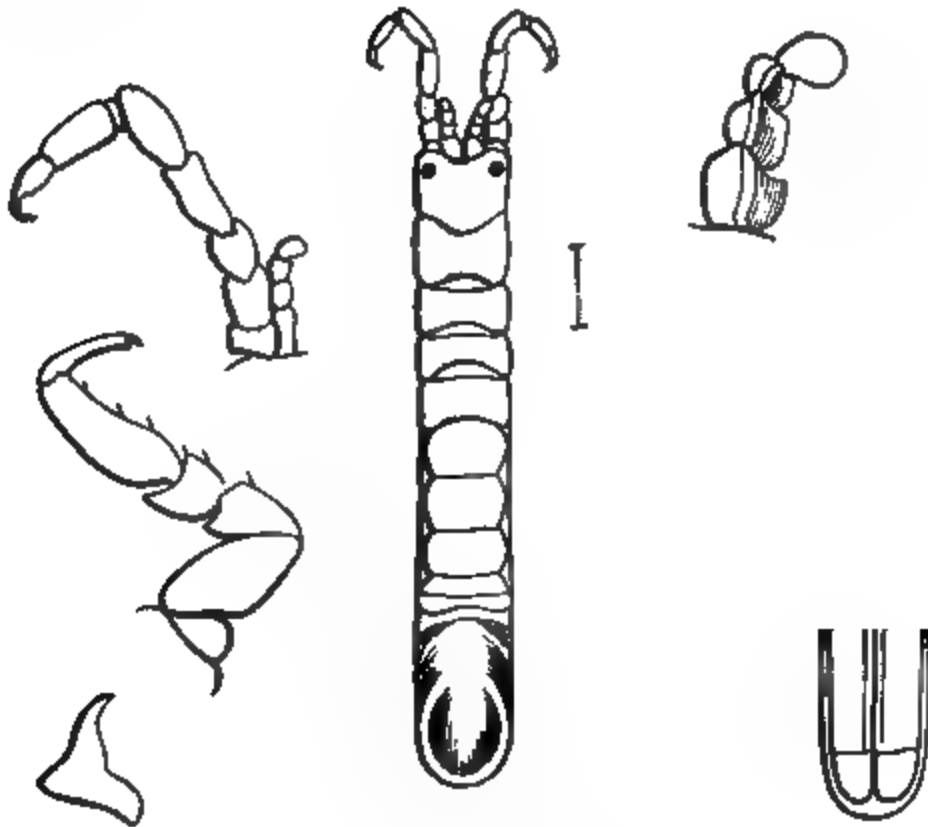
We have received specimens from Cumbray from Mr. Robertson; from Guernsey, Falmouth, and the coast of Durham from the Rev. A. M. Norman; and we have dredged it in Bigbury Bay, near Plymouth, on which coast it is by no means common.

At Ilfracombe (British Museum). It was found under stones in a cove west of the Castle, Falmouth, by Mr. W. P. Cocks. It is often plentiful in the river Dee; we have received it from Torquay, and from the Mumbles, near Swansea, collected by Mr. F. Currey; from the Berwickshire coast, by the late Dr. G. Johnston; also from the coast of the County Down, Ireland, by the late Mr. W. Thompson, and Co. Cork by Mr. Humphreys.

The figure of this species in the Crochard Edition of the "Règne Animal," although stated to be of the natural size, is much too small for full-grown specimens, the antennæ too short, and the sides of the body not sufficiently parallel to be a perfect representation.

ISOPODA.
NORMALIA.

IDOTEIDÆ.



IDOTEA PARALLELA.

Specific character. Narrow, subcylindric, with the sides of the pereion parallel; eyes placed at the base of slightly elevated anterior lateral angles of the cephalon; outer antennae not one-fourth of the length of the animal, with a very short two or three-jointed flagellum. Pleon rounded at the extremity, which is subobliquely truncate, with the margin elevated. First pair of legs larger than the succeeding.

Length, one-fourth to one-half of an inch.

Idotea chelipes. Coenra, Faun. d. Regno d. Napoli. Crust. pl. 11, f. 2. Horn, Cat. Crust. p. 26 (but not of Fabricius, Mant. Ins. i, 241. Ent. Syst. ii. 506, nor of Latr. Hist. N. Ins. et Crust. vi. 372).

THIS new British species will not enter into any of Prof. Milne Edwards' divisions of the genus, founded on the structure of the basal segments of the tail, as our species possesses three distinct although very short joints, followed by a fourth joint, only indicated at the sides,

being soldered in the middle with the large terminal joint, of which the posterior portion is subobliquely deflexed, with the extremity rounded, without any appearance of terminal or lateral points. The upper antennæ consist of four short but very robust joints, angulated at the margins. The outer antennæ are about one-fourth of the length of the entire animal, composed of a peduncle consisting of five robust joints, followed by a flagellum composed of three or four joints more or less closely soldered together. The legs are of nearly equal size, except the first, which is the largest; the coxæ or epimeral portion of the second, third, and fourth pairs appear dorsally as very narrow marginal plates, but in the three posterior pairs they are much more developed and visible from above, forming the lateral margin of each joint, with the posterior angle produced into a sharp elongated point. The first pair of legs are the most robust, the third pair the longest, and the fourth pair the shortest.

The animal is obscurely coloured, greyish-buff, with three longitudinal dusky lines, one down the middle of the back and the other two lateral.

This species appears to us to be very closely allied to, if not identical with, the genus *Cleantis* of Dana (Expl. Exped. Crust. p. 707, pl. 46, f. 9; the type of which *C. linearis* was taken was from the stomach of a *Silurus*, in the Rio Negro, North Patagonia), the characters of which appear insufficient to warrant its separation from *Idotea*.

We have obtained this species from Falmouth, taken by Mr. Barlee, and from Polperro, whence it was sent to us by Mr. Loughrin.

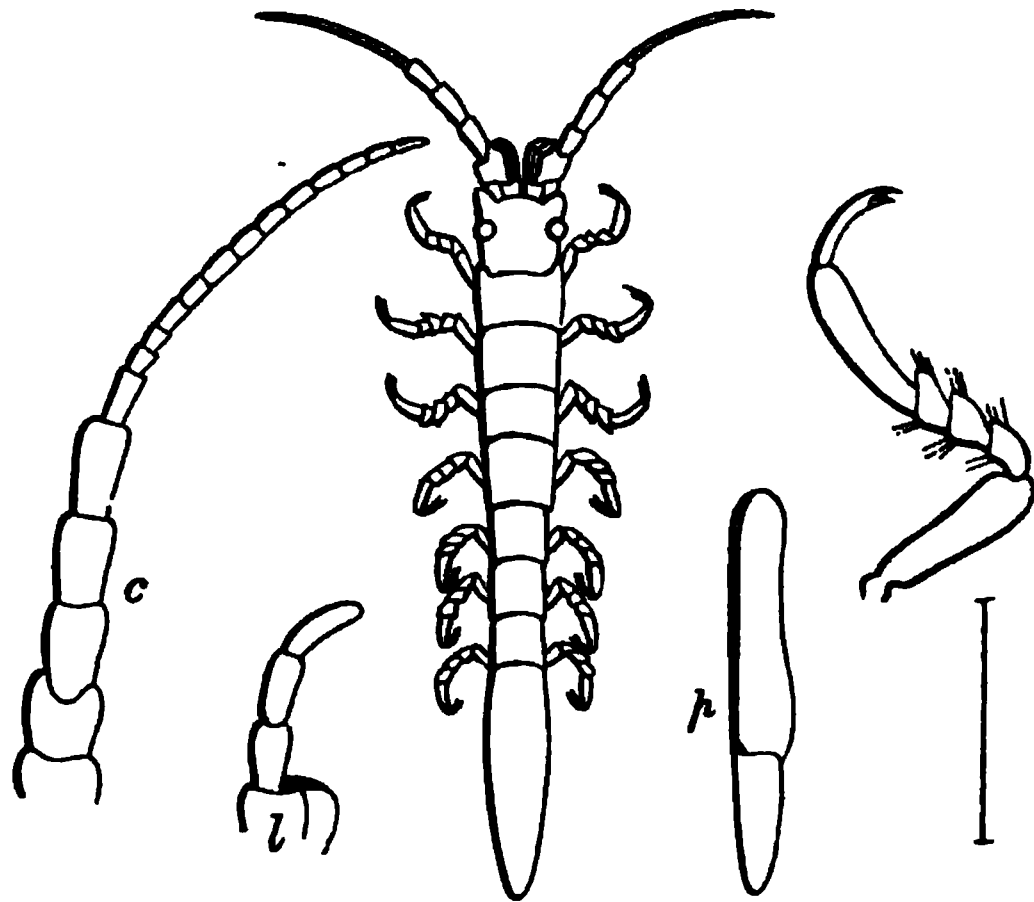
The Hopeian Collection contains numerous dry specimens, to which the label "Naples" is attached; they

agree entirely with Costa's description and figure of *Id. chelipes* in form and structure, as well as with another specimen in the same collection labelled by Signor Costa himself.

It is evident, however, that the *C. chelipes* of Fabricius and Latreille cannot be identified with the animal before us, the "*Cauda*" *tridentata* of the Fabrician description being entirely distinct from the remarkable character of the extremity of the tail of *I. parallela*. Signor Costa states of his species, "Trovasi ne' mari d'Inghilterra e di Zelandia," taking the habitat from Pallas by regarding his species as the *Oniscus linearis* of Pallas' "Spic. Zool." fasc. 9, t. 4, f. 17 and 18. These figures are indeed bad, but there can be little doubt that they represent small and narrow specimens of *I. tricuspidata*, and we believe Fabricius was correct in referring Pallas' figures to his *C. chelipes*, as Pallas describes the tail of his species as obscurely tridentate, and indeed refers his *linearis* to *O. chelipes* of his former work, from which probably Fabricius had taken it up.

ISOPODA.
NORMALIA.

IDOTEIDÆ.



IDOTEA ACUMINATA.

Specific character. Long and narrow. Lateral margins of the segments of the pereion more or less rounded. Legs subequal. Pleon composed of a single joint, elevated along its middle and produced into an obtuse point. Colour pale, with three paler longitudinal streaks, edged with dusky.

Length, one-half to three-fourths of an inch.

Stenosoma acuminatum. LEACH, Edinb. Enc. vii. p. 433. Trans. Linn. Soc. xi. p. 366. PENNANT, Brit. Zool. 4, pl. 18, f. 3. (?)

Idotea acuminata. WHITE, B. M. Cat. Brit. Crust. p. 66. Pop. Hist. Brit. Crust. p. 224.

Idotea capito. BATHKE, Faun d. Krym, p. 384, pl. 6, f. 7—9. (?)

Our figure of this species was taken from Dr. Leach's type in the British Museum (No. 1,002). It is unfortunately in very bad condition, having been pinned whilst in a soft state, so that the sides of the body have curved downwards, and our figure consequently represents the animal as having its lateral margin much too continuous,

instead of each of the joints being rounded at the sides, and causing that part of the animal to be wider than its tail.

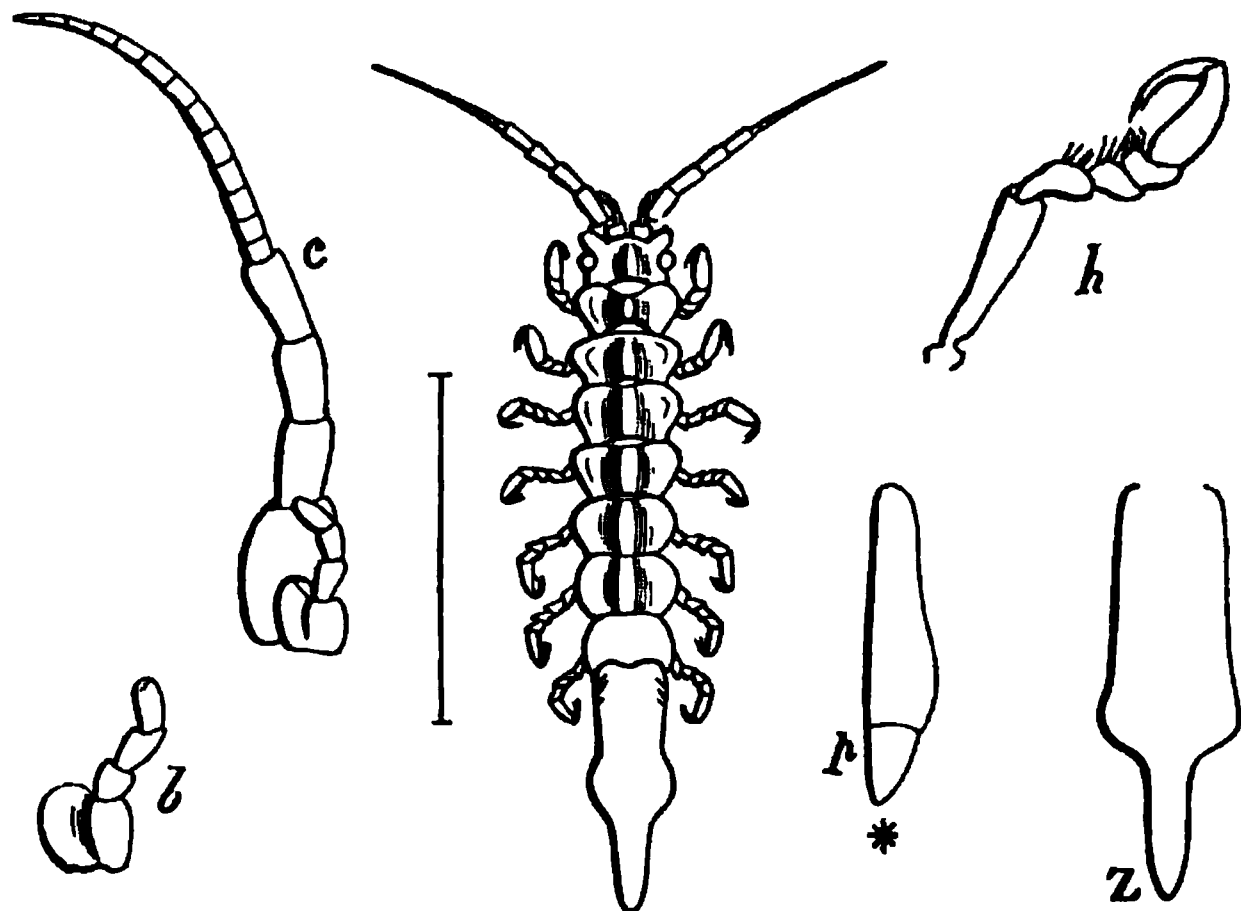
The eyes are placed in the middle of the lateral margins of the head, the anterior-lateral angles of which are considerably porrected; the outer antennæ are about half the length of the animal, with the flagellum multi-articulate and longer than the peduncle. The epimeral base of the second, third, and fourth pairs of legs are visible dorsally on the anterior-lateral angles of the segments to which they respectively belong, whilst they are more distinct in the three posterior pairs, and occupy the posterior-lateral angles, which are rounded off. The tail is narrower than any of the segments of the body, and is nearly cylindrical, with the extremity pointed, the middle of the back forming a slight ridge. This part of the body appears to consist of a single joint, but on carefully examining its sides (near the base), traces will be observed of two incisions, indicating two obliterated basal joints.

The British Museum specimens are from Dr. Leach's Collection, taken in Devonshire. Mr. W. P. Cocks found it in trawl refuse, at Gwyllyn Vase, Falmouth; there are several specimens in fine preservation in the Hopeian Collection at Oxford, labelled, "South West Coast of England," and we have received it from Cumbray, from Mr. Robertson of Glasgow.

This species is also given in the List of British *Isopoda*, in the Reports of the British Association for 1860, p. 225.

ISOPODA.
NORMALIA.

IDOTEIDÆ.



IDOTEA APPENDICULATA.

Specific character. Very narrow. Pereion with the lateral margins angularly produced, with the slender legs attached close to their edges. Pleon lanceolate, and apparently only one-jointed.

Length, about an inch.

Leptosoma appendiculata. RISSO, Hist. Nat. de l'Eur. Merid. vol. v. p. 107, t. 4, f. 28.

Idotea appendiculata. MILNE EDWARDS, Crust. iii. p. 135. WHITE, B. M. Cat. Brit. Crust. p. 66. Pop. Hist. Brit. Crust. 224.

Leptosoma lancifer. LEACH, MSS. in Brit. Mus.

OUR figure of this species is drawn from Dr. Leach's specimen from Sidmouth, contained in the British Museum collection. The body, somewhat irregular on its upper surface, is narrowed and considerably flattened, with the segments strongly produced and angulated at the sides, the angles being formed (except in the first segment) by the exposed epimeral or coxal joint of the legs. The

upper antennæ have the basal joint short, but very much dilated; the basal joint of the outer antennæ is not visible from above; the four following joints are moderately robust and nearly equal in length; the flagellum is long, slender, and multiarticulate. The eyes are placed in the middle of each side of the head, the anterior-lateral angles of which are strongly produced and rounded. The legs are slender and attached close to and beneath the lateral angles of each of the segments of the body.

The tail is considerably elongated, being about one-third of the length of the entire animal; it is lanceolate in form, being more or less suddenly dilated at a short distance beyond the middle. It appears to consist of only a single segment, but faint traces of articulations can be seen at each side near the base.

Besides Dr. Leach's Sidmouth specimen, which is labelled *I. lancifer*, the British Museum possesses specimens from Ilfracombe, collected by Mr. Gosse, and we have received it from Polperro from Mr. Loughrin.

The species is also given in the List of *Isopoda* in the Reports of the British Association for 1860, p. 225.

The Sub-tribe SPHÆROMIDEA,
CONSISTING of the single
Family SPHÆROMIDÆ,

is distinguished by the comparatively small size of the species of which it is composed, which have the body short, broad, and very convex, often contractile into a ball, in both which respects they may be regarded as marine representatives of the terrestrial wood-lice. The foot-jaws are elongated, and in some species at least (*e.g.*, *Sph. serratum*) they have the terminal joints not dilated at the inner apical angle, so as to become palpiform; but our numerous dissections prove that this character is not constant in those species in which these joints are considerably produced,—as in *Sphæroma Prideauxiana*, *Cymodocea emarginata*, &c. The head is large and transverse. The mandibles are robust and angulated at the extremity, the tips formed into several distinct teeth, below which is a strong molar tubercle. Externally, also, the mandibles are furnished with a palpiform three-jointed appendage. The first pair of maxillæ consist of two long slender lobes, the outer of which is most robust, and armed with a short strong spine at its tip, whilst the inner is terminated by long slender setæ. The second pair of maxillæ are very delicate and membranous, and terminated by three nearly equal-sized oval ciliated plates, forming the extremities of the three terminal joints. The upper antennæ are fixed at the anterior margin of the head, which does not extend over them. All the antennæ

are inserted close together, in the middle of the front of the head, and have a multiarticulate flagellum. The segments of the body do not exhibit, when viewed dorsally, the epimera-like structure of the basal joints of the legs observable in the *Idoteidæ*. In some few species the first or the first two pairs of legs are subcheliform (as in the genus *Ancinus*); but the third pair are always simple. In the majority, all the legs are slender, and simply formed for walking, with a generally bifid terminal finger. The basal segments of the tail are more or less rudimentary, and in general soldered together more or less completely, so as to form, apparently, only a single joint, which in many species is furnished with large tubercles or spines. The five pairs of branchial feet (pleopoda) are affixed obliquely on the underside of the large joint of the tail, which is deeply excavated for their reception. They are very delicate and membranous in their structure, the three anterior pairs being strongly ciliated on their apical and external edges; and the second pair, in the males, are furnished with an elongated slender-pointed style. The terminal pair of the tail-legs (uropoda) consist of two horizontal plates, of which the outer only is movable, the inner one being either occasionally obsolete, or soldered to the basal support. They are attached at the sides of the terminal joint near its anterior margin.

Professor Milne Edwards has proposed a separate family (*Sphæromiens chelifers*) for the reception of a remarkable new genus (*Ancinus*), upon a specimen of unknown locality contained in the British Museum, which has the first two pairs of legs terminated by large and strong hooks, and the body so flat as to be almost foliaceous. The inner plate of the lateral appendages of the tail is wanting, whilst the outer is greatly elongated; but

Dana has reduced this family to the rank of a sub-family, and has separated *Nisæa* and *Campecopea*, as a sub-family, from the remainder of the genera.

The species of this family frequent the rocky shores of the ocean, amongst *Thalassiophytæ*, or under stones and along the muddy banks of estuaries. Others, however, are generally found adhering to marine plants floating on the surface of the sea, and some exotic species eat deeply into water-logged timber, like *Limnoria*. They are able to run and swim with considerable agility, and afford a large supply of food to fishes.

ISOPODA.

SPHÆROMIDÆ.

NORMALIA.

Genus—SPHÆROMA. (*Latreille.*)

Generic character. Animal capable of rolling itself into a ball. Cephalon small, with the eyes dorsally situated at the posterior angles. Antennæ small. Pereion much broader than the cephalon, with seven distinct segments, having the first laterally anteriorly produced, so as to reach the anterior margin of the cephalon. Coxæ small. Pleon having all the segments fused together, with the posterior margin entire. Uropoda consisting of a peduncle that is posteriorly produced into a long, flat, oval process, carrying a single ramus which is articulated near the base.

THE genus, as originally designed by Latreille, was co-extensive with the present family (with the exclusion of the remarkable genera, *Circeis* (Australian), *Amphoroidea* (Chilian), *Cassidina* and *Ancinus* (both of unknown locality), four genera recently established by Professor Milne Edwards. Dr. Leach, however, in his Memoir in the "Dictionnaire des Sciences Naturelles," divided it into seven genera, most of which have subsequently been adopted by Latreille and other carcinologists; the typical genus Sphæroma comprising most of those species which are able to roll themselves up into a ball, at which time the lateral appendages of the tail are not visible.

These animals are of small size, rarely reaching to the length of half an inch.

The body is of a more or less oval form, very convex, and rounded at each end, thus differing from the Cymothoæ, which have the anterior part of the body much narrowed. The head is broad and vertical, having a frontal elevated transverse ridge which is continuous with the lateral margin of the body. The eyes are very wide apart, placed at the superior lateral angles of the head, and received into an emargination on each side of the first segment of the body. The antennæ are inserted close together in the middle of the anterior surface, on each side of a small frontal prominence which is joined below to the epistome; they fall back and are protected (when unemployed) by being lodged within a groove beneath the lateral margin of the head and anterior segment of the body; the upper or inner pair are affixed at the sides of a small triangular frontal prominence, and have a very broad and flattened, nearly quadrate, basal joint, followed by a second smaller one; the third as long as the second, thin and cylindrical, followed by a short, slender, articulated flagellum, consisting of about a dozen articuli. The lower or outer antennæ are considerably longer than the upper, with the basal portion composed of four moderately thickened joints and a multiarticulate flagellum. The epistome is generally quite distinct from the upper lip, and is produced above into a point, nearly meeting the point of the upper triangular piece above mentioned; on its lower edge it is very deeply emarginate, receiving the base of the upper lip or labrum, of which the anterior margin is nearly straight. The mandibles are strong and horny, strongly angulated at the extremity, and terminated in that part by two slender denticulated teeth, below which, on the inner margin, is a large and strong molar tooth. Near the middle of the

outer margin is affixed a triarticulated appendage.* The inner maxillæ consist of two nearly equal curved blades, the inner of which is ciliated at the tip, and the outer armed with strong spines. The outer maxillæ are terminated by three oval, very delicate plates, strongly ciliated. The foot-jaws are large and strong, and close the mouth; they are composed of a strong, basal joint, followed by a small joint, and are furnished with a large triangular inner lobe, and terminated by four strong joints of nearly equal length, but gradually diminishing in thickness, and strongly ciliated. In some of the species these four joints are internally produced into a large lobe; the lower lip is rounded at the sides and very deeply notched in the middle of the fore-margin.

The first segment of the body is larger than the following, and strongly produced backwards at its posterior lateral angles; the six following segments are marked at the sides with an impressed oblique line indicating the coxæ or epimeral base of the legs; the seventh segment of the body is very short, and does not extend outwardly so far as the first segment of the tail (pleon), which is marked on each side with two transverse striæ, which do not unite in the middle of the back, but which represent three segments coalesced together. The terminal joint is large, and marked at its base with a rather deep transverse channel. The legs are of nearly equal size; they are terminated by a bifid finger. The tail-plates (pleopoda) consist of six pairs, five folding obliquely upon each other, and received in a deep excavation on the underside of the tail, of which the two last are furnished with bran-

* Savigny (Egypte Crust., pl. 12, f. 1 i,) represents the middle joint as divided into two, probably arising from the appendage having been twisted in this part in the specimen dissected by him.

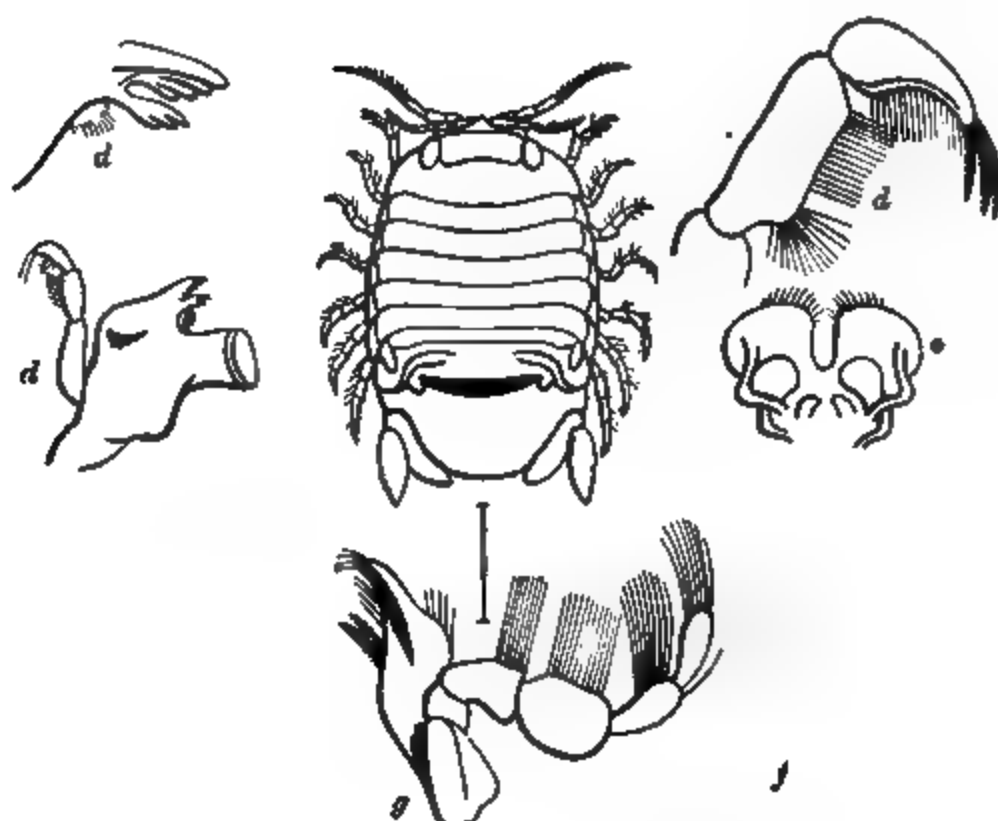
chial organs; the last or sixth pair are crustaceous, and terminated by two nearly equal oval plates, of which the outer is movable, and folds under the inner, which is soldered to the basal support.

They are vegetable feeders, and some species have recently been described by Dr. Fritz Muller, from the Brazils and Madras, which were found living as extensive perforators in submarine timber.

ISOPODA.

NORMALIA.

SPHÆROMIDÆ.



SPHÆROMA SERRATUM.

Specific character.—Smooth, oval, very convex; pleon rounded at the extremity, which is entire; outer division of the terminal appendages of the pleon slightly serrated, extending as far back as the extremity of the last segment.

Length, about half an inch.

- | | |
|---------------------------|---|
| <i>Oniscus serratus.</i> | FABRICIUS, Mant. Inet. 1, p. 242. |
| <i>Cymothoa serratum.</i> | FABRICIUS, Ent. Syst. ii. p. 510. |
| <i>Sphæroma serrata.</i> | LEACH, Edinb. Enc. vii. p. 405. Suppl. Enc. Brit. 1427. Trans. Linn. Soc. xi. p. 368. Dict. des Sci. Nat. xii. p. 346. SAMOUELLE, Ent. Compend. p. 108. DESMAREST, Cons. Crust. p. 301, t. 47, f. 3. LATREILLE, Ency. Méth. x. p. 458. GUÉRIN MÉNEV., Icon. R. An. Crust. t. 30, f. 1. MILNE EDWARDS, Crust. iii. p. 205, t. 31, f. 11. WHITE, B. M. Cat. Brit. Crust. p. 75. Pop. Hist. Brit. Crust. p. 245, pl. xiii. f. 6. GOSSE, Man. Mar. Zool. i. f. 235. |

- Oniscus globator.* PALLAS, Spic. Zool. ix. t. 4, f. 18.
Sphæroma cinerea. BOSCH, Hist. Crust. 11, p. 186. LATREILLE, Hist. n. Crust. et Ins. vii. p. 16. Genera Crust. et Ins. 1, p. 65. SAVIGNY, Exped. Egypt. Crust. t. 12, f. 1.

THIS is the largest British species, sometimes attaining the length of half an inch. It is very convex, and has the surface of the body quite smooth. It is broadly ovate, the greatest breadth being in the middle of the animal. The front of the head is nearly straight, and elevated into a thin marginal line, in the middle of which, beneath, is affixed the small triangular piece between the base of the superior antennæ, the two dilated basal joints of which do not extend to the inner angle of the eyes, whilst the flagellum extends slightly beyond the base of the flagellum of the lower antennæ. The seventh segment of the body (pereion) is very short, and on each side, near the extremity of its posterior margin, is a small, somewhat triangular incision, which is filled up by a minute but distinct rudimental portion of the real first segment of the tail, of which no other portion is visible; the first apparent segment consisting of three joints, of which incisional traces may be observed in the two lines on either side, which are quite lost in the middle of the disc, which is quite smooth, simple, and entire. The terminal segment is very convex; it is narrowed on each side for the reception of the flat curved inner lobe of the lateral appendages (uropoda), beneath which the outer lobe is generally concealed; thus forming, with the terminal segment of the tail, nearly a semicircle, of which the posterior extremity is slightly truncate. The outer margin of the lateral appendages is furnished with five or six serrations. Sometimes the posterior extremity of the tail is somewhat elongated into a flattened and more truncated plate, in which state it appears to have been

formed into a distinct species, *Sph. trigonum*, by Risso (Crust. de Nice, p. 147).

When alive, the body is ashy coloured or whitish, varied with reddish and dark grey; the eyes black; the antennæ fulvous; the legs ashy, with fulvous claws tipped with black.

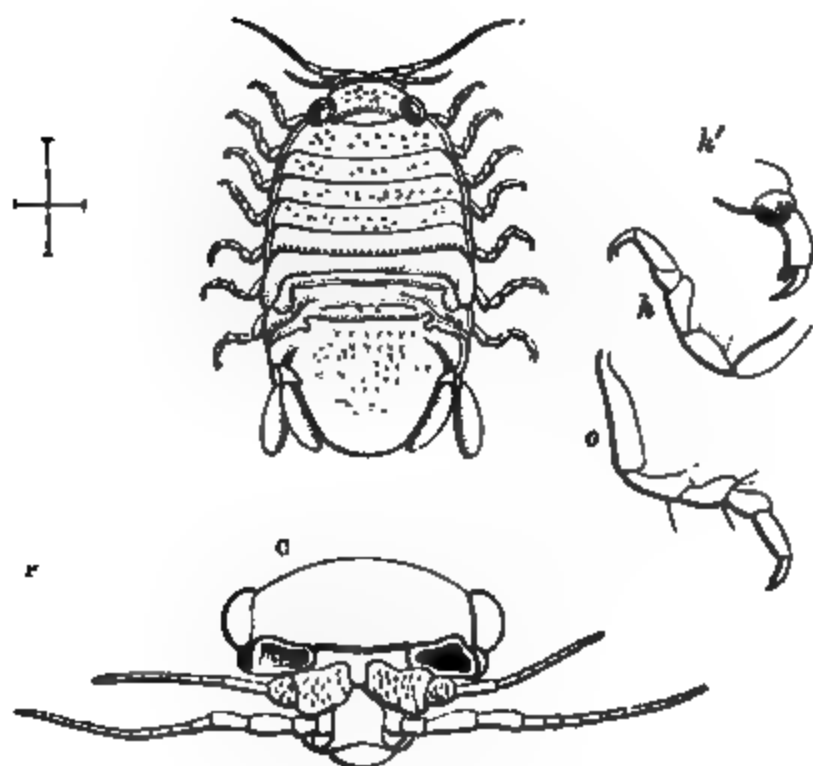
Young individuals, measuring not more than two lines in length, have the outer edges of the side appendages of the tail (uropoda) entire, and not serrated.

This species lives in numerous societies under stones and amongst the pebbles and gravel of the coast; and is found on the English and French coasts of the English Channel, from Kent to Cornwall, and in the Mediterranean. We have dredged fine specimens in Plymouth Sound in the month of August. Dr. Kinahan obtained it in the River Lagan, Belfast, and in the River Dodder, Dublin. We have observed quantities in the brackish streams on Loughor Marsh, near Swansea, mixed with *Palaemon*, *Carcinus*, and *Talitrus*.

ISOPODA.

NORMALIA.

SPHÆROMIDÆ.



SPHÆROMA RUGICAUDA.

Specific character. Body smooth, moderately convex ; tail rounded and entire at the extremity, its upper surface rugose ; outer division of its lateral appendages oval and entire.

Length, four-tenths of an inch.

Sphæroma rugicauda. LEACH, Edinb. Enc. vii. pp. 405 and 493. Trans. Linn. Soc. xi. p. 369. Dictionn. Sci. Nat. xii. p. 846. DESMAREST, Cons. Crust. p. 300. MILNE EDWARDS, Crust. iii. p. 207. JOHNSTON, Zool. Journ. 3, 180. WHITE, B. M. Cat. Brit. Crust. p. 75. Pop. Hist. Brit. Crust. p. 245.

THIS species closely resembles the preceding, but it is less convex, and is easily distinguished by the rugose or granulated upper surface of the tail, and sometimes of the hinder segments of the body, and the simple outer margin of the external division of the uropoda.

The head is narrower than the following segment,

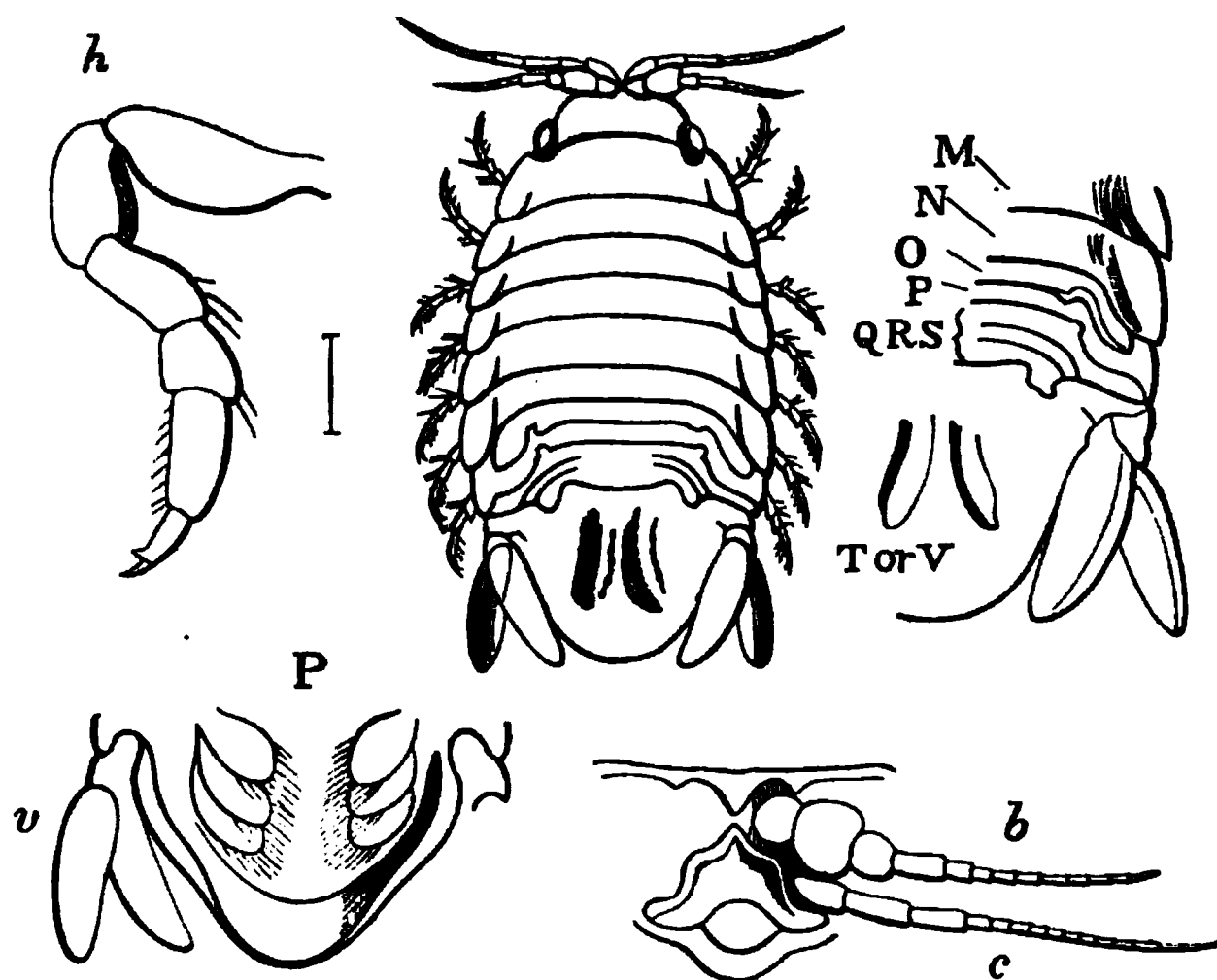
having the eyes on each side, which do not touch the external margins, and are not quite round in their outline; the superior antennæ are about half the length of the inferior; the flat basal joints are punctate; the segments of the body are nearly equal, short, and convex; the terminal segment of the tail is rounded behind and obliquely truncate at the sides; the two plates of its lateral appendages are equal, of a linear-oval shape, neither ciliated nor serrated on the outer edge.

When alive, it is of an ashy colour, with dots and streaks of black, and is often marked with a light coloured stripe down the back; it is much more active than the preceding species, swimming with considerable velocity and often on its back, and contracting itself into a ball when alarmed; it can live a long time out of water.

It occurs on the coasts of France and Great Britain. Dr. Leach took it very abundantly on the island of Ulva, near Mull (one of the Hebrides), and also at the mouth of the River Tamar, in Devonshire. Dr. Johnston also sent it to us from Berwick-upon-Tweed, and Dr. Kinnahan dredged it at Blockhead, in Belfast Bay.

ISOPODA.
NORMALIA.

SPHÆROMIDÆ.



SPHÆROMA HOOKERI.

Specific character. Upper surface nearly smooth ; terminal segment of the pleon rounded at its extremity ; the two last segments of the pleon bicarinated ; the carinæ but slightly elevated ; those of the terminal segment sometimes interrupted, so that each forms two tubercles.

Length, one-third of an inch.

Sphæroma Hookeri. LEACH, Edinb. Enc. vii. p. 433. Trans. Linn. Soc. x. p. 369. Dict. Sci. Nat. xii. p. 345. DESMAREST, Cons. Crust. p. 300. MILNE EDWARDS, Crust. iii. p. 206. WHITE, B. M. Cat. Brit. Crust. p. 76. Pop. Hist. Brit. Crust. p. 245.

THIS species was found by the late Sir William Hooker on the coast of Suffolk, and was described by Dr. Leach (to whom it had been sent, together with his entire collection of crustacea, by that gentleman), as being ashy-grey or reddish coloured, dotted with black points ; the antennæ ashy. In one individual the “small posterior ventral plate” had its extremity slightly serrated, and the

surface of the tail bicarinated, as mentioned in the specific character given above.

Mr. A. White states that the Rev. Alfred Norman had found it at Clevedon, and in Guernsey.

We have not been able to discover the type specimens of this species in Dr. Leach's collection in the British Museum, and give the above characters from his description. The accompanying figure is taken from specimens which we have no doubt belong to this species, and which were captured by the late Mr. W. Thompson in Belfast and Strangford Loughs.* These are more elongated than *Sph. serratum*, and the upper surface of the body is slightly granulated on the posterior segments, as well as the tail, the last segment of which bears two well-marked carinæ, not quite parallel, the extremity of the segment being rather flattened, elongated, and rounded at the tip, without any trace of notch at the sides. The two plates of the lateral appendages of the tail are elongate-ovate, and entire. They extend backwards as far as the produced extremity of the terminal segment.

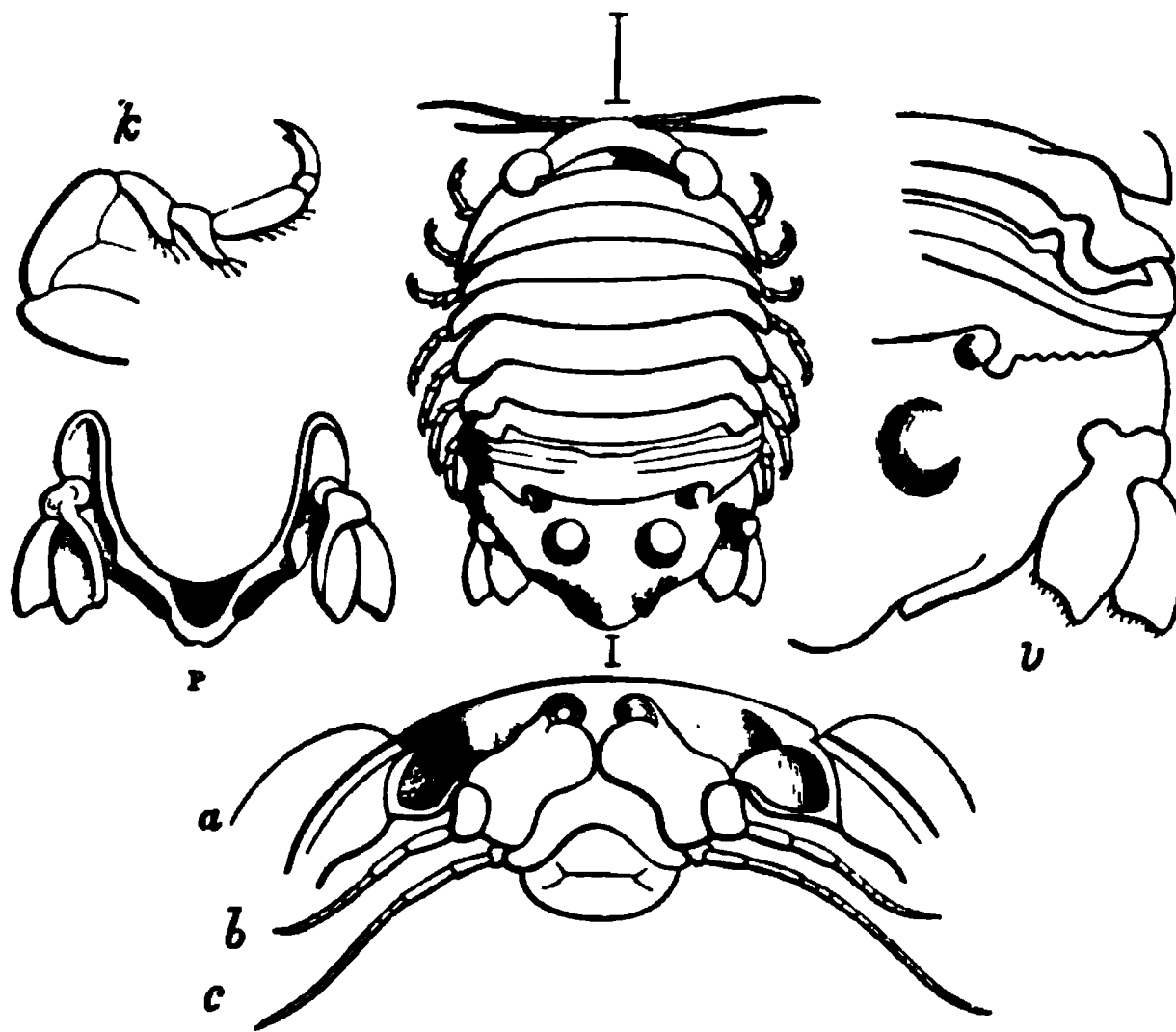
Whilst this sheet has been going through the press we have received specimens of this species from Mr. Slade, who found them at Bexhill, near St. Leonard's, in brackish water affected by land drainage.

* One of these individuals, labelled Belfast, is mixed up with specimens of *S. serratum* in the British Museum collection.

ISOPODA.

NORMALIA.

SPHÆROMIDÆ.



SPHÆROMA CURTUM.

Specific character. Upper surface smooth ; second, third, and fourth segments of the pereion terminating laterally in a sharp point on each side ; the three following more oval at the lateral extremities. Terminal segment of the pleon with two large rounded and broad tubercles ; extremity produced in the middle into an obtuse point, with a notch on each side ; both plates of the lateral appendages of the tail obliquely truncate.

Length, one-fourth of an inch.

Sphæroma curtum.

LEACH, Dict. Sc. Nat. xii. p. 345. DESMAREST, Cons. Crust. p. 209. MILNE EDWARDS, Crust. iii. p. 209.

Var. *Sphæroma Griffithsii*. LEACH, MSS. in Brit. Mus. W. THOMPSON, in Ann. Nat. Hist. xx. p. 246. WHITE, B. M. Cat. Brit. Crust. p. 76.

THIS species is now for the first time described and figured from Dr. Leach's typical specimen in the British Museum, named by him *Sph. Griffithsii*, which we consider to be a fully developed individual of *Sph. curtum*,

and from which the following description is made, as well as the accompanying figures are taken.

The upper surface of the animal is quite smooth. The head is produced into a small, somewhat hastate point in front. The upper antennæ have the very large flat basal joint affixed by a small rounded rotule; the second joint of these antennæ is transversely oval, followed by two slender joints, and about eight articuli, forming the flagellum. The lower antennæ are but little longer than the upper. The first segment of the body is dilated at the sides; both the anterior and posterior angles being pointed and produced. The three following segments are pointed at the extremity of the lateral margins; and the three terminal segments have the lateral angles more ovate. The tail has the first segment distinctly indicated by a transverse slightly impressed line, extending across the whole breadth of its base, the middle portion of the line extending rather more backwards than the side portions, which reach only to the inner portion of the terminal lateral lobe of the seventh segment of the body. The second, third, and fourth segments of the tail are confluent in the middle of the back, and in certain lights the posterior margin of this confluent mass exhibits traces of two small tubercles, wide apart, in front of the two large dorsal rounded tubercles of the terminal segment. The last segment has the middle of its extremity produced into an obtuse point, which is slightly notched on each side; and on looking at the animal from behind this part appears semitubular, the produced apex forming a small arch. The lateral appendages of the tail do not extend so far back as its extremity, and they have both divisions obliquely truncate, and very slightly emarginate. In the above woodcut the right-hand figure *v* represents the right-hand portion of the hind part of the body and

tail seen from above, whilst in the figure P is represented the under surface of the tail, omitting the membranous respiratory plates (pleopoda).

Fully developed specimens above described were found at Torbay by Mr. Griffiths, after whom it was named by Dr. Leach; and the late Mr. W. Thompson found several closely packed within the shell of a *Balanus* fixed on a *Modiola vulgaris* in Belfast Bay; some specimens in the British Museum are from Lamlash Bay, in the Isle of Arran.

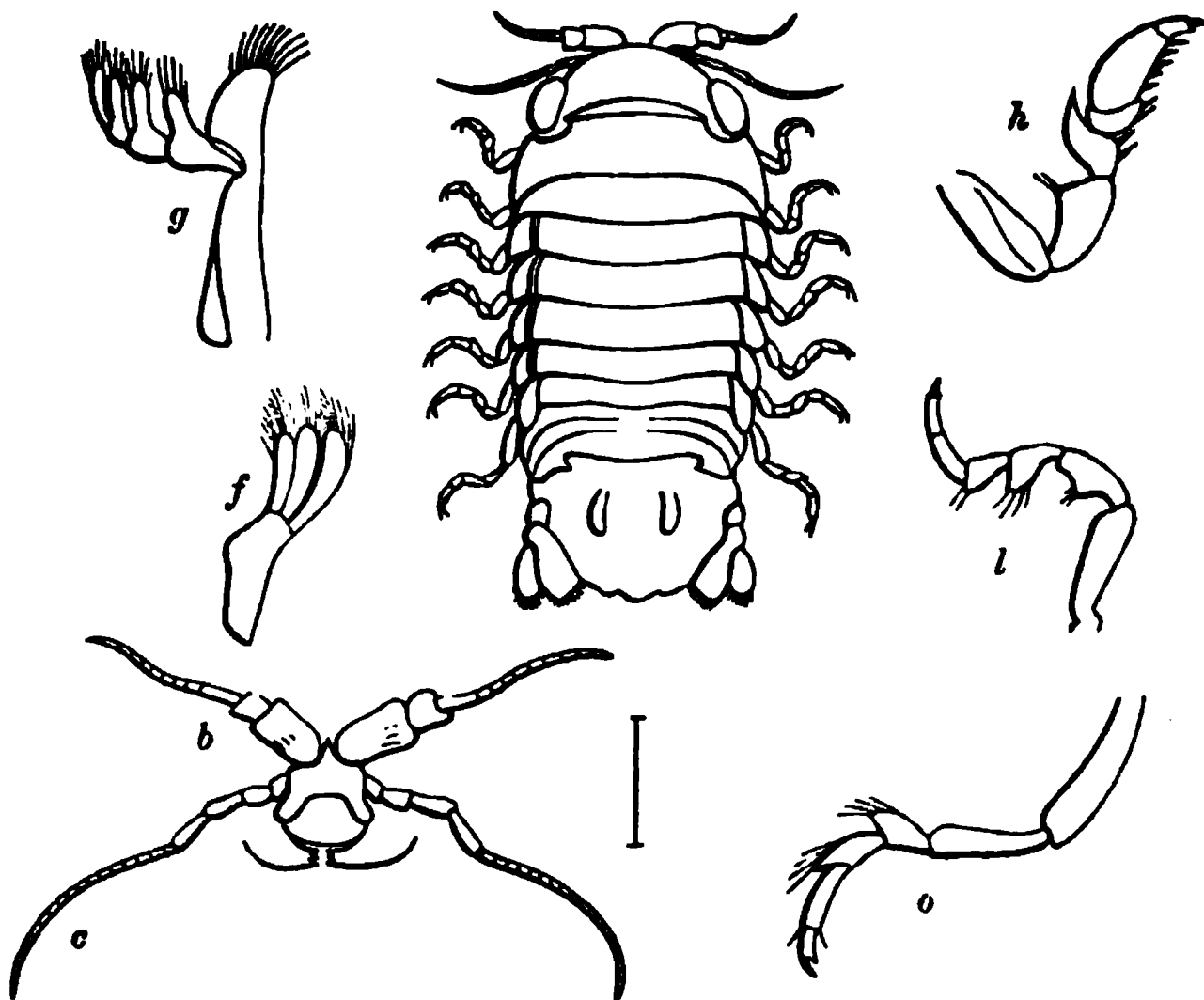
The smaller individuals, as we believe them to be, which served Dr. Leach for his vaguely described *Sph. curtum*, differ only from the preceding in having the tubercles of the terminal segment of the tail scarcely elevated, and the body somewhat narrower. Dr. Leach placed the species in his section "with the terminal segment of the abdomen having its extremity furnished with two small notches," and having "the third segment of the abdomen widely notched posteriorly, whilst the last segment is pointed at its tip." Professor Milne Edwards is unable to comprehend this apparently contradictory description. The fact is, however, that the wide notch of the third segment of the tail is produced by the two angular lateral incisions towards the sides of the posterior margin of the confluent basal joints, whilst the extremity of the tail itself is obtusely pointed, with a notch on each side of the obtusely projecting extremity. The upper surface of the terminal segment exhibits only two very slight elevations, in the place of the rounded tubercles of the larger variety above described. The lateral appendages of the terminal segment of the tail are comparatively small, and obliquely truncated.

The smaller variety was first taken by Montagu on the south-west coast of England.

ISOPODA.

NORMALIA.

SPHÆROMIDÆ.



SPHÆROMA PRIDEAUXIANUM.

Specific character. Oblong-ovate ; cephalon very broad. Segments of the pereion entire, convex ; pleon with the penultimate joint produced into an angulated lobe on each side of the posterior margin ; last joint with two oblong carinæ in the middle of the upper surface ; extremity produced into an obtuse point, slightly notched on each side.

Length, one-third of an inch.

Sphæroma Prideauxianum. LEACH, Dictionn. Sci. Nat. xii. p. 345. DESMAREST, Cons. Crust. p. 299. MILNE EDWARDS, Crust. iii. p. 209. W. THOMPSON, Ann. Nat. Hist. xx. p. 245. WHITE, B. M. Cat. Brit. Crust. p. 76.

OUR description and figure of this species are taken from Dr. Leach's type in the British Museum. It is more oblong than the preceding ; but has the two plates of the lateral appendages of the tail short, the inner one being obliquely truncate. The upper antennæ have the two basal joints broad and flat, the third joint slender,

followed by a slender nine-jointed flagellum. The lower antennæ are slender, having the four basal joints slender, the first and second shorter than the third and fourth, which are equal. The flagellum is slender, and consists of seventeen articulations. The foot-jaws differ from those of the typical species, in having each of the three intermediate joints dilated into an internal flattened lobe, a character which, in conjunction with that of the short plates of the lateral appendages of the terminal segment of the body, seems to indicate a more than specific distinction, and which is probably also found in *Sph. Griffithsii*, which appears to be congeneric. The five posterior segments of the body have their lateral portions separated by a slender impressed line (indicating the basal division of the legs attached to each of them), and the hind segment of the tail is marked with two elongated carinæ; its extremity is obliquely rounded, with a small notch on either side.

We regret that the paucity of individuals which we have been able to examine of this and the preceding species, and its supposed variety *Sph. Griffithsii*, do not allow us so satisfactorily as we could have wished to determine the real position of the latter, which may possibly belong to the present species, having the tubercles on the tail nearly obliterated.

Dr. Leach obtained his unique specimen from Mr. C. Prideaux, who took it on the west coast of Devonshire.

We possess a specimen of the species of *Sphæroma* figured by Savigny in the great work on Egypt. Crust. pl. 12, f. 4, distinguished from *Sph. serratum* by its more elongated form, flattened triangular head, and especially by the semicircular notch at the extremity of the tail. We believe it to be British; but being unable to speak with precision on the subject, we have omitted to figure it in the present work.

ISOPODA.
NORMALIA.

SPHÆROMIDÆ.

Genus—DYNAMENE. (*Leach.*)

Generic character. Smooth, not bristly; contractile into a ball, with the lateral appendages of the pleon exposed; terminal segment having a deep excavation in the middle of the posterior margin. Superior antennæ with the basal joint oblong, not flattened, and the second joint sub-triangular.

THE species of this genus have much the appearance of small Sphæromæ, but are distinguished from them by the slit at the extremity of the tail, which is simple, without a central tooth, as in Cymodocea, from which they also differ in the smooth clean aspect of the dorsal surface, and in the structure of the basal joints of the superior antennæ.

The body is very convex, smooth, and destitute of the bristles which are so conspicuous in the Cymodoceæ. The upper antennæ, when at rest, are concealed beneath a slightly produced margin to the front of the head; the basal joint is oblong and but slightly flattened, the second joint is triangular-shaped, and the flagellum is multiarticulated; the lower antennæ are more slender at the base than the upper, with four nearly equal basal joints, and a moderately long multiarticulate flagellum. The mandibular appendage has the two terminal joints subequal and strongly setose on the inner edge; the apex of the mandible is armed with several minute denticulated teeth and a slender setigerous lobe in the middle of the apical edge; the foot-jaws have the intermediate joints

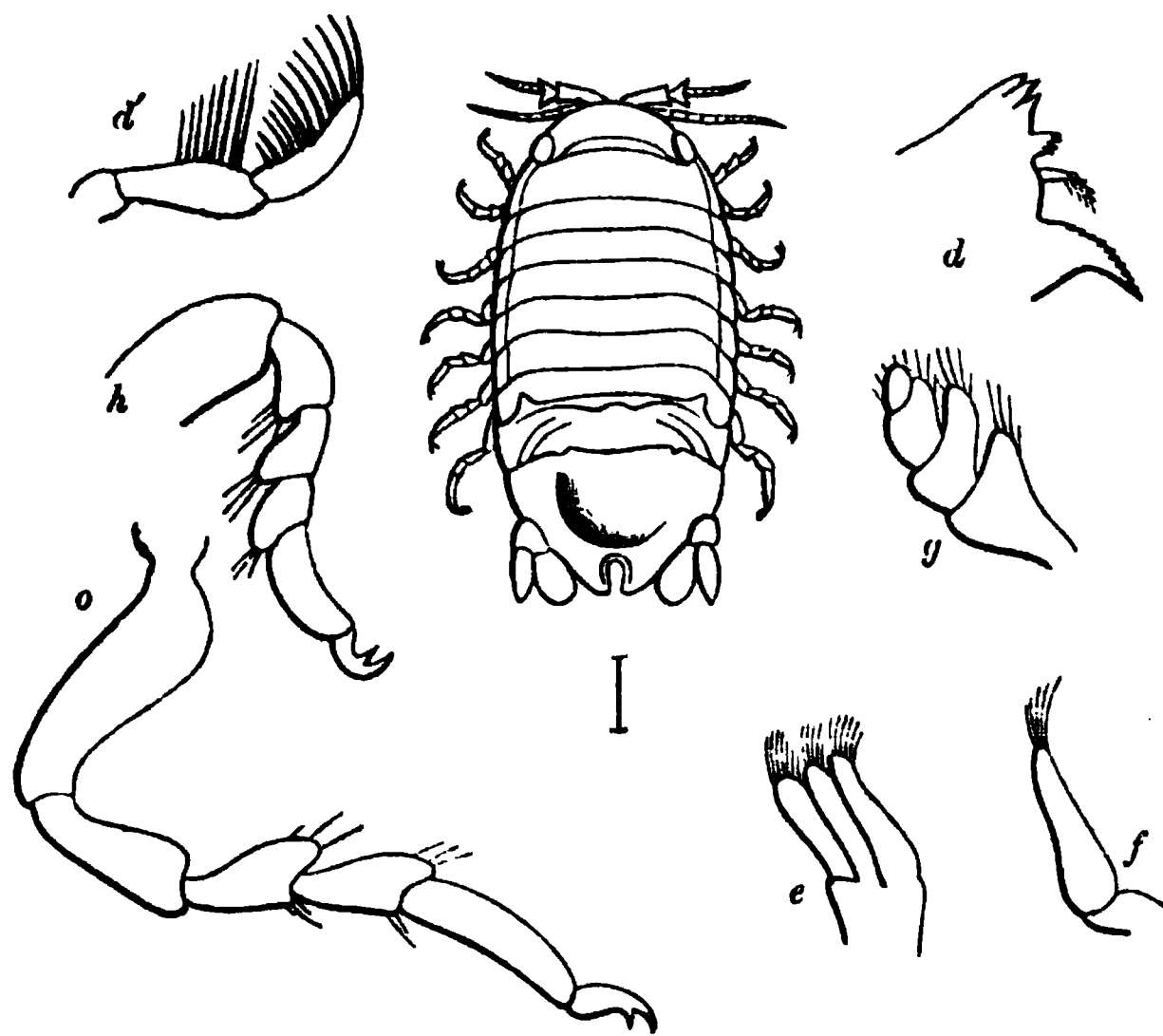
moderately produced at the inner angle. The maxillæ are very delicate and thin membranous plates, setose at the tip. (In our figures of the second maxillæ in *D. rubra* and *Montagui*, only one of the lobes was observed on dissection.) The legs are moderately robust, terminated by a strong hook, having a small tooth on its inner edge. The tail is terminated by a simple slit, not enclosing a central tooth, and the lateral appendages have the outer lobe exposed.

The species are of small size, and agree in their habits with the Sphæromæ. They frequent rocky coasts, preferring them on account of the small rock-pools which abound in such situations, in which they reside. They are also found among *Thalassiophytæ* at low water. They swim with much quickness and elegance, turning themselves over on their backs and executing various evolutions with great agility. They are probably common all round our coasts.

ISOPODA.

SPHÆROMIDÆ.

NORMALIA.



DYNAMENE RUBRA.

Specific character. Narrowly ovate, with the sixth segment simple; outer plate of the uropoda shorter than the inner; central excavation in the terminal margin of the pleon of equal width throughout. Colour reddish or greyish buff, with black or red specks.

Length, one-fifth of an inch.

Oniscus ruber. MONTAGU MSS.

Dynamene rubra. LEACH, Dictionn. Sci. Nat. xii. p. 344. DESMAREST, Cons. Crust. p. 298. •

Cymodocea rubra. MILNE EDWARDS, Crust. iii. p. 216. WHITE, B. M. Cat. Brit. Crust. p. 77. Pop. Hist. Brit. Crust. p. 247.

THIS species is rather narrow in form, with the sides of the body but little arched; the sixth segment is considerably larger than the seventh, and is unarmed at its posterior margin; the terminal segment of the tail is large and very convex, and is terminated by a longitudinal slit, which is nearly of equal width throughout its

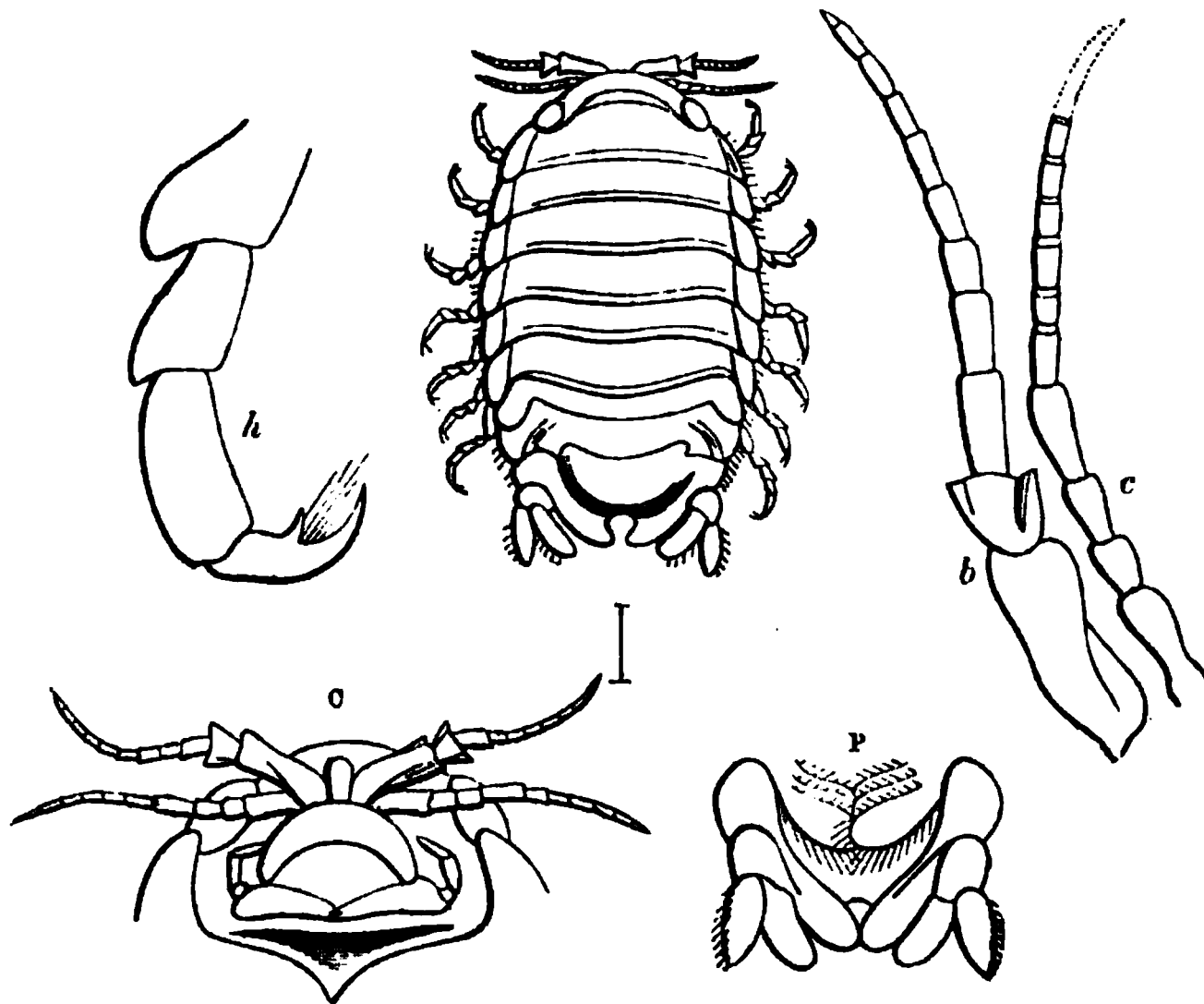
entire length. The outer plate of the lateral appendages of the tail is considerably smaller than the inner, which is broadly ovate. When alive, the animal is of a reddish colour, being covered with numerous red dots, or greyish buff with black specks; the articuli of the flagellum of the antennæ are tipped with red, and the anterior segments of the body have a red transverse line beyond the middle of each.

It is stated by Dr. Leach that this species is very common on the south-west coast of England, where it was first taken by Montagu. We have taken it at Firestone Bay, near Plymouth. It has also been taken at Cumbræ, in the Firth of Clyde, by the Rev. A. Norman; and at Bangor, in Ireland, in September, by the late Mr. W. Thompson; and probably occurs all round our coast.

ISOPODA.

SPHÆROMIDÆ.

NORMALIA.



DYNAMENE VIRIDIS.

Specific character. Broadly ovate; sixth segment simple; terminal segment of the pleon centrally very convex, with an outer flattened margin, and a terminal excavation, which is widest at its base. Colour green. Outer plate of the uropoda rather smaller than the interior.

Length, about one-fifth of an inch.

Dynamene viridis. LEACH, Dictionn. Sci. Nat. xii. p. 344. DESMAREST, Cons. Crust. p. 298.

Cymodocea viridis. MILNE EDWARDS, Crust. iii. p. 216. WHITE, B. M. Cat. Brit. Crust. p. 77. Pop. Hist. Brit. Crust. p. 267.

THIS species is distinguished from the preceding by its broadly ovate form, and from the following by the sixth segment of the body being destitute of an incumbent spine; the dorsal surface is even, and destitute of ciliæ. The upper antennæ are separated from each other at the base by a small oblong lobe; the second

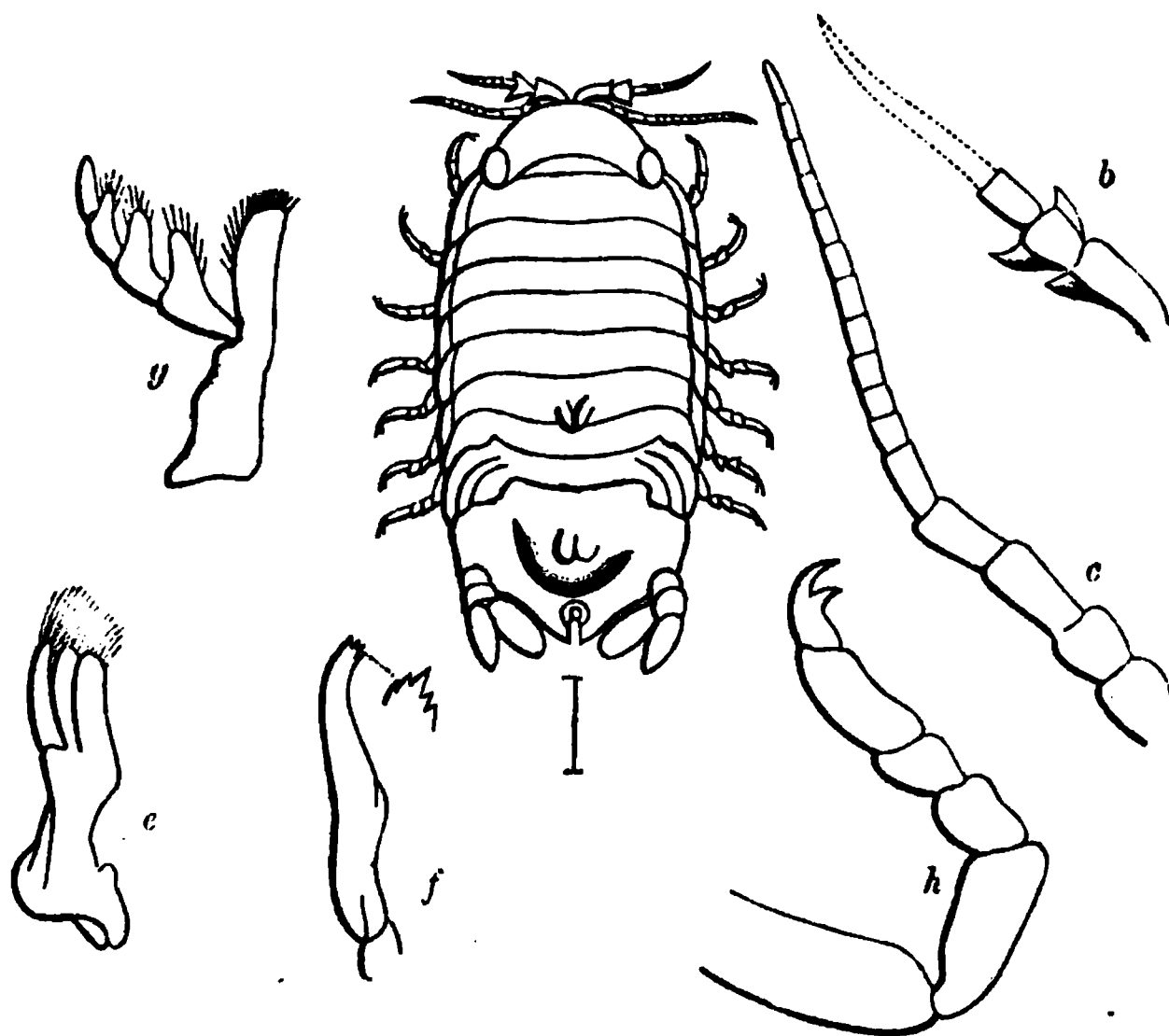
joint is obconical, and the flagellum multiarticulate. The last joint of the tail is centrally very convex, but the outer margin, both laterally and posteriorly, is flattened, and the terminal slit is considerably widened at its base; the extremities of the sides of the slit sometimes closely approximating or touching each other; the lateral appendages have the outer division rather smaller than the inner. The dactylos of the feet is armed on its inside with a strong tooth. Our figure c represents the head seen from the front, the oral appendages are therefore represented as foreshortened.

In the young state, the sides of the terminal slit of the tail gape to a considerable width at their extremities.

Montagu and Leach found this species in company with the preceding in great quantities, and Mr. W. Thompson took it at Lahinch, in Co. Clare, Ireland.

ISOPODA.
NORMALIA.

SPHÆROMIDÆ.



DYNAMENE MONTAGUI.

Specific character. Rather narrow ; sub-parallel. Sixth segment of the pereion produced in the middle of its hind margin into a triangular lobe ; outer plate of the uropoda longer than the inner.

Length, one-fourth of an inch.

Dynamene Montagu. LEACH, Dict. Sci. Nat. xii. p. 344. DESMAREST, Cons. Crust. p. 298.

Cymodocea Montagu. MILNE EDWARDS, Crust. iii. p. 215. WHITE, B. M. Cat. Brit. Crust. p. 77. Pop. Hist. Brit. Crust. p. 266.

THIS species is rather narrow, with the sides of the body somewhat parallel. The dorsal surface is marked with minute slightly impressed punctures. The sixth segment is produced in the middle of its hind margin

into a flattened triangular lobe, the centre of which is longitudinally impressed. The hind margin is also furnished on each side (about half way between the middle and lateral angles) with a minute but prominent tubercle. The terminal segment of the tail is very convex, with a transverse bipartite tubercle in the middle; the terminal margin is incised in the centre with a small longitudinal slit. The outer plate of the lateral appendages of the tail is narrowly ovate, and pointed at the tip; it is somewhat longer than the inner lobe, which is slightly obliquely truncated.

This species was taken by Dr. Leach on the western shores of Devonshire, and named in honour of Colonel Montagu, whose researches on marine zoology added so greatly to our knowledge of the native fauna. We have taken it among *Fuci*, between tide marks on the coast of South Wales, South Devon, and Cornwall. It is probably tolerably common on rocky beaches all round our coast. It is generally found associated with *Dynamene rubra* and *Næsa bidentata*.

ISOPODA.

SPHÆROMIDÆ.

NORMALIA.

Genus—CYMODOCEA. (*Leach.*)

Generic character. Not capable of being completely rolled into a ball. Pleon very rugose, deeply excavated at the tip, with a lobe or tooth in the middle. Uropoda with the plates elevated obliquely, so as not to shut under each other, the inner plate being a process of the peduncle.

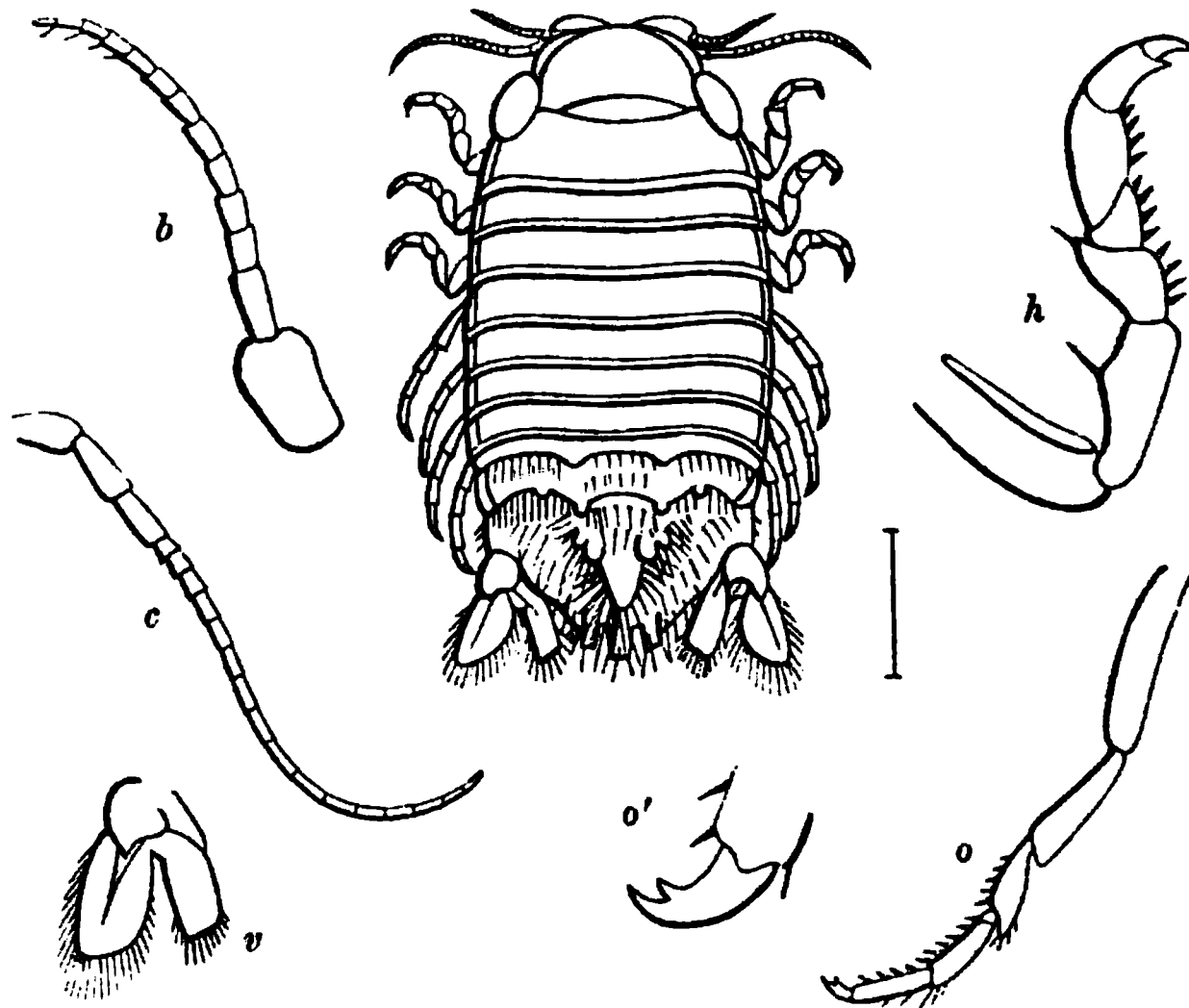
THESE species are easily distinguished by the very rugose and setose segments of the tail, which is terminated by a deep notch, within which is a produced central plate or lobe. The body is more parallel at the sides than in *Sphæroma*, all the segments being simple. These characters will at once distinguish the genus both from *Sphæroma* and *Dynamene*, which latter has been united with it as a second section by Professor Milne Edwards.

The head is nearly as broad as the broadest part of the body. The flagella of both pairs of antennæ are multi-articulate. The penultimate segment of the tail (forming the posterior margin of the consolidated basal mass) is prolonged in the middle and emarginate, the terminal segment bearing in the centre of its upper surface a compound tooth or spine, and the extremity of the tail is deeply notched, with a short horn or lobe in the middle of the notch. The foot-jaws have the intermediate joints prolonged on the inner margin, the extremity of the lobes thus formed being thickly ciliated. The lateral appendages of the tail have two small lobes, which are strongly ciliated with stiff short hairs, which also are thickly scattered upon the upper surface of the segments of the tail.

ISOPODA.

NORMALIA.

SPHÆROMIDÆ.



CYMODOCEA TRUNCATA.

Specific character. Pleon slightly granulated; fourth segment with two small tubercles in the middle of the hind margin; terminal segment with two larger dorsal tubercles, followed by a central oval, very setose tubercle, and three terminal spines, which are truncated.

Length, five-twelfths of an inch.

Oniscus truncatus.

MONTAGU MSS. in Brit. Mus.

Cymodocea truncata.

LEACH, Edinb. Enc. vii. p. 433. Trans. Linn. Soc. xi. p. 303. Suppl. Enc. Brit. i. 427. Dictionn. Sci. Nat. xii. p. 343. SAMOUELLE, Ent. Compend. p. 108. DESMAREST, Cons. Crust. p. 297. MILNE EDWARDS, Crust. iii. p. 214. W. THOMPSON, in Ann. Nat. Hist. xx. p. 246. WHITE, B. M. Cat. Brit. Crust. p. 76. Pop. Hist. Brit. Crust. p. 246. GOSSE, Man. Mar. Zool. 1, fig. 236.

Our figure of this species is made from Dr. Leach's typical specimen preserved in the British Museum. It is very nearly allied to the following species, but it is much less rugose, and the form and size of the lateral appendages of the tail are different in the two species.

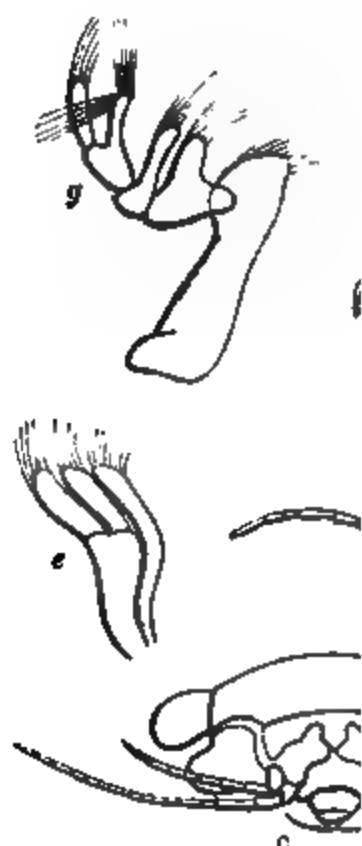
The body is somewhat cylindrical, with the sides nearly parallel. The entire length of the animal is about two and one-fourth times the width of the middle of the body. The antennæ are short, the inferior being about as long as the breadth of the head; the superior have the basal joint (omitted in our upper left-hand figure) strongly punctured. The tail has the upper surface irregular and setose. The basal portion has the middle of the posterior margin extended backwards, and emarginate, with two small tubercles near the angles of the emargination. The large terminal joint has two large oval setose tubercles in the middle of the upper side, followed by a slightly convex lobe, on which the bristly setæ are set in a diverging manner; and the extremity of the joint is armed with three flat truncated spines. The lateral appendages of the tail do not close as in the *Sphæromæ*, so as to form a convex shield, but are carried obliquely upwards; the inner division is small and obliquely truncate, with the entire margin thickly set with strong bristles, and the outer division is considerably larger and oval in form, but with the outer angle subacute. The inner portion of this outer plate is partially folded when at rest beneath the inner plate.

This species was taken by Montagu and Leach on the Devonshire coast; but very sparingly. The Rev. A. Norman dredged it in Lamlash Bay, in the Isle of Arran, and found it under rocks at low water at Herm; and the late Mr. W. Thompson took it in Belfast Bay, at Rockport, in April, and Mrs. Hyndman on Cultra shore, in September, and Dr. Macintosh has sent it to us from St. Andrews.

ISOPODA.

NORMALIA

SPHÆROMIDÆ.



CYMODOCEA EMARGINATA.

Specific character. Upper surface of the posterior part of the pereon, and especially also of the pleon, granulose, the latter sparingly clothed with short stiff bristles, having two tubercles on the hind margin of the basal portion, and two larger in the middle of the last segment, which has an oval lobe in the deep apical notch.

Length, nearly half an inch.

Cymodocea emarginata. LEACH, Dictionn. Sci. Nat. xii. p. 343. DESMARET, Cons. Crust. p. 296. MILNE EDWARDS, Crust. iii. p. 214. WHITE, B. M. Cat. Brit. Crust. p. 77. Pop. Hist. Brit. Crust. p. 246, pl. xiii. f. 7.

THIS species is much more granulose on the upper surface than the preceding; the granules gradually increasing in size beyond the middle of the body. The head is very broad, and the eyes large. The basal joints of the antennæ are punctured; the terminal articuli of

the flagellum of the upper pair (represented without the two basal joints in the middle right-hand figure), are furnished with flattened hairs at the tips. The foot-jaws have the three middle joints produced into long lobes, strongly ciliated at the tips, a portion of the cilia of the penultimate joint being set on at an obtuse angle to the rest. The basal portion of the tail has the middle of the hind margin extended backwards and emarginate, with a more or less distinct tubercle on each angle of the emargination. The middle of the upper surface of the terminal joint has two larger tubercles, followed by a depressed space, terminating generally in an erect tooth or obtuse point, the extremity of the joint armed with three obtuse points. The lateral appendages are very rugose and ciliated, the outer division nearly oval, but produced on the outside, at the tip, into a point; the inner division is narrower and curved, with the tip pointed.

Dr. Leach took this species at Plymouth, under Mount Edgecombe. Mr. John Cranch found specimens, less strongly granulose, at Falmouth. We have received it from near Glasgow, taken by Mr. Robertson. The late Mr. W. Thompson found a specimen within the shell of a *Balanus*, affixed upon a *Modiola vulgaris*, from Belfast Bay.

ISOPODA.

SPHÆROMIDÆ.

NORMALIA.

Genus—NÆSA. (*Leach*).

(Nesæa—White. Næsea—M. Edwards.)

Generic character. With the sixth segment of the pereion enlarged, and dorsally produced into a strong bidentate process. Pleon with the upper surface irregular and setose. Uropoda with the articulated ramus greatly elongated.

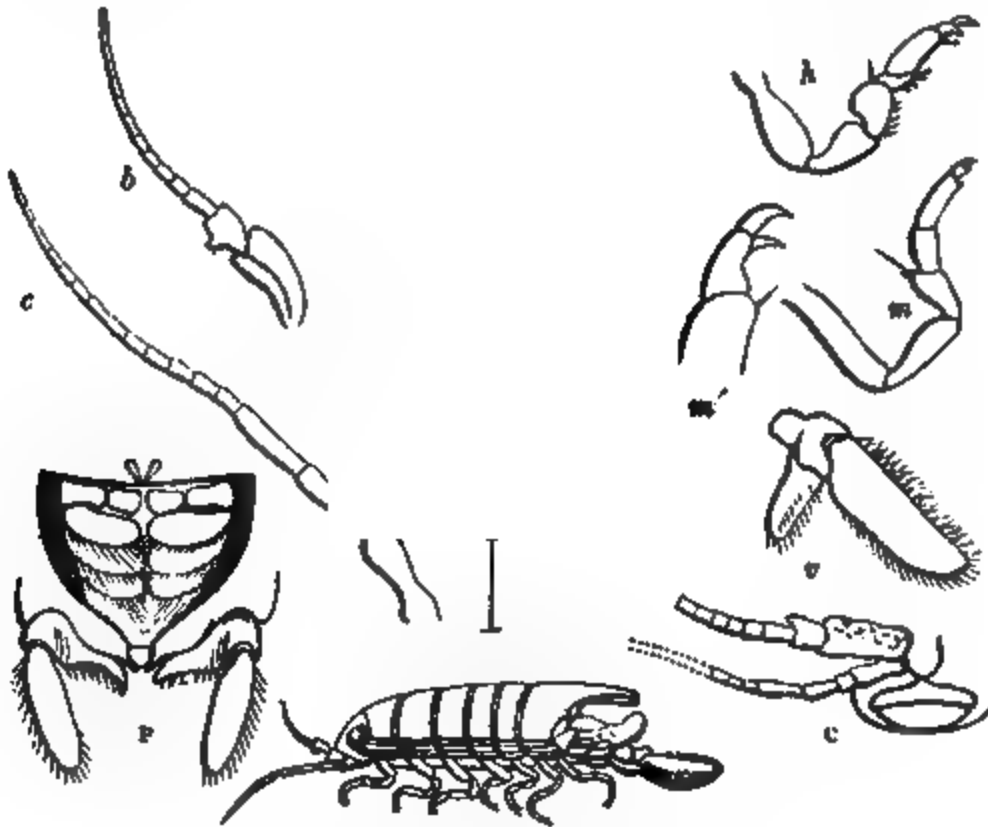
THE dorsal surface of the body is smooth, but the sixth segment is slightly rugose, and is armed at its hind margin with two sharp processes extending over the tail, which has the upper surface irregular, with two large rounded tubercles in the middle: the outer plate of the lateral appendages of the tail is greatly elongated, and extends considerably backwards, whilst the inner plate is fixed, and transversely directed inwards, nearly meeting the corresponding division of the opposite appendage behind the middle of the hind margin of the tail. This peculiar structure of the tail and its appendages prevents the animal from rolling itself into a ball in the same manner as the *Sphæromæ*, with which, in other respects, these animals are nearly allied. The nearest approach is, however, made to *Dynamene Montagui*, in which the sixth segment of the body shows traces of the two processes of *Næsa* in the bipartite tubercle of its posterior margin.

The upper antennæ are separated at the base by an oblong protuberance; the basal joint is thick, oblong, and rugose; the second joint small, with the apical angles acute; the flagellum multiarticulate.

ISOPODA.

SPHÆBROMIDÆ.

NORMALIA.



NÆSA BIDENTATA.

Specific character. Colour ashy, varied with reddish or bluish streaks; sixth segment of the pereon large, overhanging the base of the pleon, which has two oval rugose tubercles in the middle.

Length, about one-third of an inch. "Six lines"—Leach.

- Oniscus bidentatus.* ADAMS, Trans. Linn. Soc. vol. v. p. 8, t. 2, f. 3, 4.
Næsa bidentata. LEACH, Dict. Sci. Nat. xii. p. 341. Edinb. Enc. vii. p. 405. Trans. Linn. Soc. xi. p. 367. Suppl. Enc. Brit. i. p. 427. SAMOUËLLE, Ent. Compend. p. 108. MILNE EDWARDS, Crust. iii. p. 217. DESMAREST, Cons. Crust. p. 295, t. 47, f. 2. WHITE, B. M. Cat. Brit. Crust. p. 78. Pop. Hist. Brit. Crust. p. 247, pl. xiv. f. 1. GOSSW, Man. Mar. Zool. 1, 185, fig. 237.

THIS species is at once distinguished from all the other British species of the family by the structure of the large sixth segment of the body, armed on its hind margin in the middle with two long divergent, slightly incurved rugose teeth, which completely conceal the

seventh segment of the body and the basal portion of the tail. The body is rather narrow, and smooth on the upper side of the anterior portion. The tail is very rugosely granulated, and furnished in the middle of its upper surface with two erect tubercles. The outer division of the lateral appendages extends considerably beyond the extremity of the body; it is oblong, and slightly pointed at its extremity; its surface rugose, and its edges strongly bristly.

Taken on the south-west coast of England* by Montagu and Leach; also at Polperro, Cornwall, by Mr. J. Couch; at Carrickfergus, Lough Shinny, Dublin, by Dr. Kinahan; Cork, Professor J. R. Greene; Roundstone, Mr. W. M'Calla; coast of Ireland, Professor Huxley; also Vagon Bay, Guernsey, by the Rev. Alfred Norman. We have found it common amongst weed between tides on the rocky shores of South Wales, South Devon, and Cornwall; and believe it may be met with in similar localities all round our coasts. It is generally associated with *Dynamene Montagui*, of which we think it may possibly turn out to be the male.

* Dr. Leach, by a *lapsus calami*, says :—"Habite les rochers de la partie occidentale de l'Amerique."

ISOPODA.

SPHÆROMIDÆ.

NORMALIA.

Genus—CAMPECOPEA. (*Leach.*)

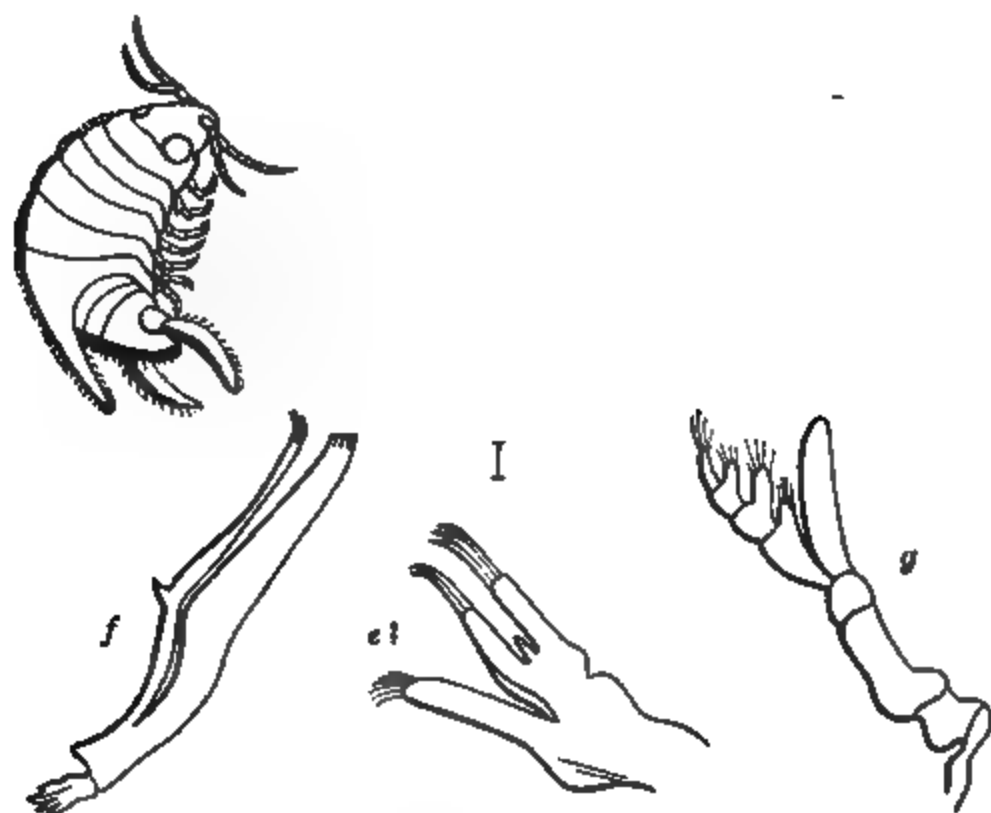
Generic character. Oval and very convex ; sixth segment of body entire, or armed with a single long tooth in the middle of its hind margin ; articulated ramus of the uropoda forming a long exserted curved plate ; interior division obsolete, or very minute.

THE species of this genus are the smallest in the present family. They have the body very much arched, and capable of doubling itself closely up, but not into a perfect ball. The sixth segment is larger than the seventh (and in some individuals, which we regard as males, it is very much enlarged), and produced in the middle of its posterior margin into a long tooth, which extends backwards over the tail, but varying in length in individuals according, probably, to the period of their growth. This remarkable tooth, not having been represented by Montagu, has been overlooked in the descriptions of the genus and its species by Desmarest and other later writers, although originally mentioned by Leach in the "Dictionnaire des Sciences Naturelles." The seventh segment of the body is very short, as is also the basal division of the tail, whereas the terminal division of the latter is of large size, rounded behind, entire, and armed at each side with the greatly elongated, curved, lateral appendages, the outer division of which is setose, and the inner appears to be obsolete, or very minute. The foot-jaws have the intermediate joints produced into rounded lobes at the inner apical angles. The antennæ are cylindrical, with the basal joints thickened.

152

ISOPODA.
NORMALIA.

SPHÆROMIDÆ.



CAMPECOPEA HIRSUTA.

Specific character. Hirsute; sixth segment having the middle of the posterior margin, armed with a long straight tooth, extending backwards. Colour brown; pleon marked with pale blue dots.

Length, one-eighth of an inch.

- Oniscus hirsutus.* MONTAGU, Trans. Linn. Soc. vii. p. 71, t. 6, f. 8.
Campecopea hirsuta. LEACH, Edinb. Enc. vii. p. 405. Trans. Linn. Soc. xi. p. 367. Dictionn. Sci. Nat. xii. p. 341. Suppl. Enc. Brit. i. 427. SAMOUELLE, Ent. Compend. p. 107. DESMAREST, Cons. Crust. p. 294, t. 47, f. 1. GUÉRIN-MÉNÉVILLE, Icon. B. An. Crust. t. 30, f. 3. MILNE EDWARDS, Crust. iii. p. 220. WHITE, B. M. Cat. Brit. Crust. p. 78. Pop. Hist. Brit. Crust. p. 248, pl. xiv. f. 2. GOSSE, Man. Mar. Zool. i. fig. 238.

THIS curious little species has the body oval, very convex, and very much arched, the upper surface being very hirsute; the tail large, semicircular, very convex, and

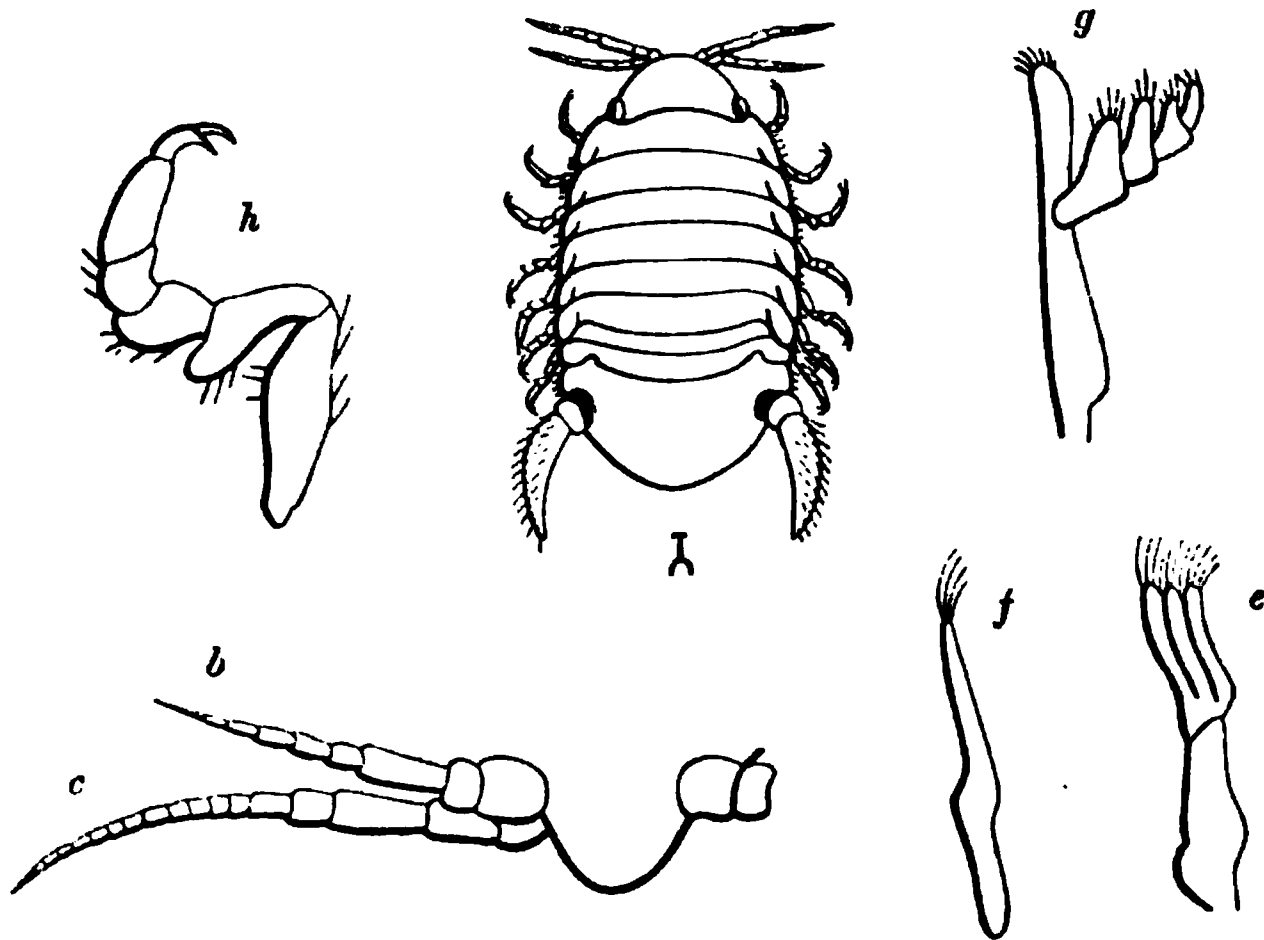
armed on each side with a long curved and serrated oar, or fin-like outer division of the posterior lateral appendages, of which the inner is apparently obsolete. The sixth segment of the body is armed with a long posteriorly deflexed spine. The seventh segment of the body is very short; the legs are terminated by a strong curved finger; the extremity of the preceding joint being also produced into a point, so as to give the appearance of double claws to the leg. The outer maxillæ are of the usual form, and the foot-jaws have a large apical lobe, whilst the intermediate joints have their inner angles produced into rounded setose lobes. In the middle figure (e?) we have represented a structure which presented itself to us on dissecting the mouth, which we consider to be the inner maxillæ, although differing from the ordinary form of those organs, which generally consist of three equal-sized membranous plates of identical form and structure, and with a similar ciliation at the tips. In figure P is represented the underside of the tail, with the omission of the delicate tail-feet or breathing-scales. The terminal segment of the tail is slightly carinated at its extremity.

The species was found by Montagu on the coast of Devonshire. We have also taken it in some profusion at Torquay and Polperro, amongst the small dry fuci that exist on the surface of the rocks within the reach of the spray of the sea, but where the sun appears to drain off all moisture.

ISOPODA.

NORMILIA.

SPHÆROMIDÆ.



CAMPECOPEA CRANCHII.

Specific character. Slightly setose; sixth segment of the pereion simple, unarmed; terminal segment of the pleon entire, convex, not carinated, at its hinder part.

Length, one-tenth of an inch.

Campecopea Cranchii. LEACH, Dictionn. Sci. Nat. xii. p. 341. DESMAREST, Cons. Crust. p. 295. MILNE EDWARDS, Crust. iii. p. 220. WHITE, B. M. Cat. Brit. Crust. p. 78. Pop. Hist. Brit. Crust. p. 248.

THIS species is smaller than *C. hirsuta*; it is also much less hirsute, and the sixth segment of the body, although larger than the preceding and following segments, is destitute of the elongated spine which exists in *C. hirsuta*. The antennæ are cylindrical; the upper pair are inserted rather widely apart, with the first and second joints thickened, the second being of the ordinary rounded form, and not having the anterior angles acute. The inner maxillæ are composed of three delicate overlapping

plates of equal size and structure, which is the ordinary type of these organs. The legs are terminated by two strong hooks. The tail has the last joint entire and convex, without any appearance of carina.

Taken at Falmouth by Mr. Cranch. We have found this species mingled plentifully with the preceding, and believe it will ultimately prove to be only the female form of *C. hirsuta*.

We take this opportunity, at the close of the descriptions of the water-breathing Isopoda, to refer to Professor Schiodte's recent elaborate memoir on the structure of the mouth of these animals, with especial reference to the parasitic suctorial species composing the family *Cymothoidæ* (of which we possess no British representative), published in the "Naturh. Tidsskrift," ser. iii., vol. iv., and of which a careful translation has just been published in the "Annals of Natural History" for January, 1868.

Division—ÆRO-SPIRANTIA.

WE have now arrived at that division of the order Isopoda which comprises the species that differ from the great majority of those animals, and indeed (with the exception of the land-crabs) from the remainder of the class Crustacea, in the manner in which respiration is effected; these animals residing, not in water, but in damp situations, and breathing air, which, however, it is necessary should be saturated with moisture, as has been fully proved by a careful series of experiments published by Messrs. Duvernoy and Lereboullet in the "Annales des Sciences Naturelles," 2nd series, Zool., tom. 15, p. 205. The specialized structures by which this is effected will be noticed below. We must here, however, refer to the exceedingly interesting genus, *Tylos* of Latreille, founded upon an Egyptian species elaborately illustrated by Savigny in the great work on Egypt (Crust. pl. 13, f. 1), in which respiration is effected in a double manner, namely, by the action of the water or moistened air on the external surface of the respiratory branchial plates or false legs on the underside of the tail, in the same manner as in the Idoteæ and other normal Isopods, and by the inspiration of air by means of certain spiracular orifices on several of the basal pairs of these same appendages. We have searched in other genera for these peculiar organs, but without hitherto being successful.

The division, which corresponds with the family Cloportides of Latreille and Milne Edwards, comprises the single

Family—ONISCIDÆ.

THESE animals are further distinguished by having the anterior pair of antennæ almost rudimental, so that they appear to possess only one pair of these organs. The tail is composed of six distinct segments; but the terminal joint, instead of being of large size, and formed into a shield-like plate, is here small, and sometimes almost rudimental. The legs are only formed for walking, and the mandibles are destitute of the lateral articulated appendage resembling a three-jointed palpus.

The species for the most part are of comparatively small size, and are indiscriminately known under the common names of wood-lice, hog-lice, carpenters, &c. With the exception of the species of *Ligia* (which comprises the largest individuals of the family, and which are found in rocky places on the shores of the ocean in various parts of the world), the Oniscidæ are inland creatures. Of fourteen species described by Professor Kinahan in his memoir on this family, read at the British Association in 1857, and published in the "Dublin Natural History Review," vol. iv., he states that all, except two (one a marine species), had been found by him in a garden not sixty yards square, and nearly all in abundance.

Several of the species which inhabit caves and subterranean situations are destitute of eyes. This is the case with *Titanethes albus*, described and admirably illustrated by Schiodte in his memoir on the cave-animals—"Specimen Faunæ Subterraneæ,"—published in the "Transactions of the Royal Society of Denmark," 5th

series, vol. ii., and which is evidently identical with Koch's *Pherusa alba* ("Herrich Schäffer, Contin. of Panzer," Fasc., 180, pl. 24). Another curious blind species, closely allied to *Platyarthrus*, has been described by Schöbl, under the name of *Typhloniscus Steinii*, in the "Proceedings of the Imperial Academy of Vienna for 1860." It lives in ants' nests. The memoir is illustrated by ten elaborate plates.

These animals have recently attracted considerable attention amongst foreign carcinologists, since, in addition to the special memoirs of Brandt ("Conspectus Monographiæ Crustaceorum Oniscodorum," in Bull. Soc. Nat. Moscow, 1833); Lereboullet ("Sur les Crustacés de la Famille des Cloportides qui habitent les Environs de Strasbourg," in the "Contes Rendus," 1845, t. 20, No. 6, and in the "Memoirs of the Nat. Hist. Society of Strasbourg" for 1853); and Professor Kinahan (of whose memoir, entitled "Analysis of certain allied Genera of Terrestrial Isopoda," in the "Natural History Review," vol. iv., 1857, and supplement in ditto, 1858 and 1859, we have greatly availed ourselves); there have been published several other memoirs, which have been greatly overlooked, namely, Burgersdijk's "Specimen Academicum inaugurale continens Annotationes de quibusdam Crustaceis indigenis," 8vo, Lugduni Batav. 1852; Schnitzler's Memoir "de Oniscineis agri Bonnensis," 8vo, Coloniæ, 1853; Stein's "Catalogue of the Crustacea and Myriapoda of the Grisons," published in the "Annual Report of the Natural History Society of the Grisons" for 1855, in which fifteen species of the family are described; and Johnsson's "Synoptisk Framställning af Sveriges Oniscider, Upsala," 1858. In Koch's "Continuation of Panzer's Deutschlands Insecten" (published also separately), not fewer than sixty-one supposed

species belonging to this family are figured; but this writer carried the creation of species, not only of these animals, but also of the *Acaridæ*, to an undesirable extent; every slight variation of colour being regarded as of specific value. It is very probable that when greater attention shall have been devoted to these creatures in this country, other species will have to be added to our native lists than are described in the following pages.

This family is divisible into two sub-families—

1. The *Ligiinæ*, having the flagellum of the outer antennæ multiarticulate, and the terminal pair of caudal appendages with the basal joints greatly elongated, and terminated by two long and slender subequal rami; consisting of the genera *Ligia* (sub-marine species), and *Ligidium*, composed of a single European species, found in damp moss.

2. The *Oniscinæ*, having the flagellum of the outer antennæ not multiarticulate, and the terminal pair of pleopoda with the basal joints very short, and furnished with two short flattened unequal rami, of which the inner is sometimes nearly obsolete, comprising the remainder of the species.

ISOPODA.

ONISCIDÆ.

NORMALIA.

Genus—LIGIA. (*Fabricius*.)

Generic character. External antennæ long, with a multi-articulate flagellum. Terminal pair of uropoda with the basal portion exserted backwards, truncated at its extremity, to which are affixed a pair of elongated cylindrical rami.

THE head is small, its anterior margin forming a continuous arched line with the sides of the first segment of the body.

“ When the head is looked down on from the front, we remark anteriorly, just beneath, but not attaining to the frontal line of the head, a broad plate extending over the entire forehead, and divided transversely by a raised ridge; its superior margin is also marked by a raised ridge. This superior ridge passes off on each side beneath the eyes, forming at least a third of the inferior border of the orbit. The external angle of the orbit, however, is formed not by this, but by the cephalic ring continued forward from behind, and terminating as a rounded knob just above the external antennæ; these arise in the angle between the inferior border of the frontal plate and the projecting lobes. The inferior border of the frontal plate is formed of two curves, convex upwards, one over the origin of each external antenna; the angle of their junction is truncate, separated by a short transverse suture from a small, narrow, somewhat quadrilateral plate, which bears the internal antennæ, and is probably the remains of the second or internal antennary ring; the frontal plate itself representing the external antennary or third ring of the typical crustacean. Beneath is a broad, well-marked plate, the epistome.”—Kinahan, *op. cit.* p. 264.

The outer antennæ are of considerable length, consisting of a strong five-jointed peduncle, of which the joints gradually increase in length, followed by a multi-articulate flagellum, which, in our only British species, contains thirteen or fourteen articuli, the last being extremely minute; but in some of the exotic species as many as thirty. The inner antennæ are very minute, flattened, and three-jointed. They are inserted close together, just above the clypeus, and are not longer than the basal joint of the outer pair.

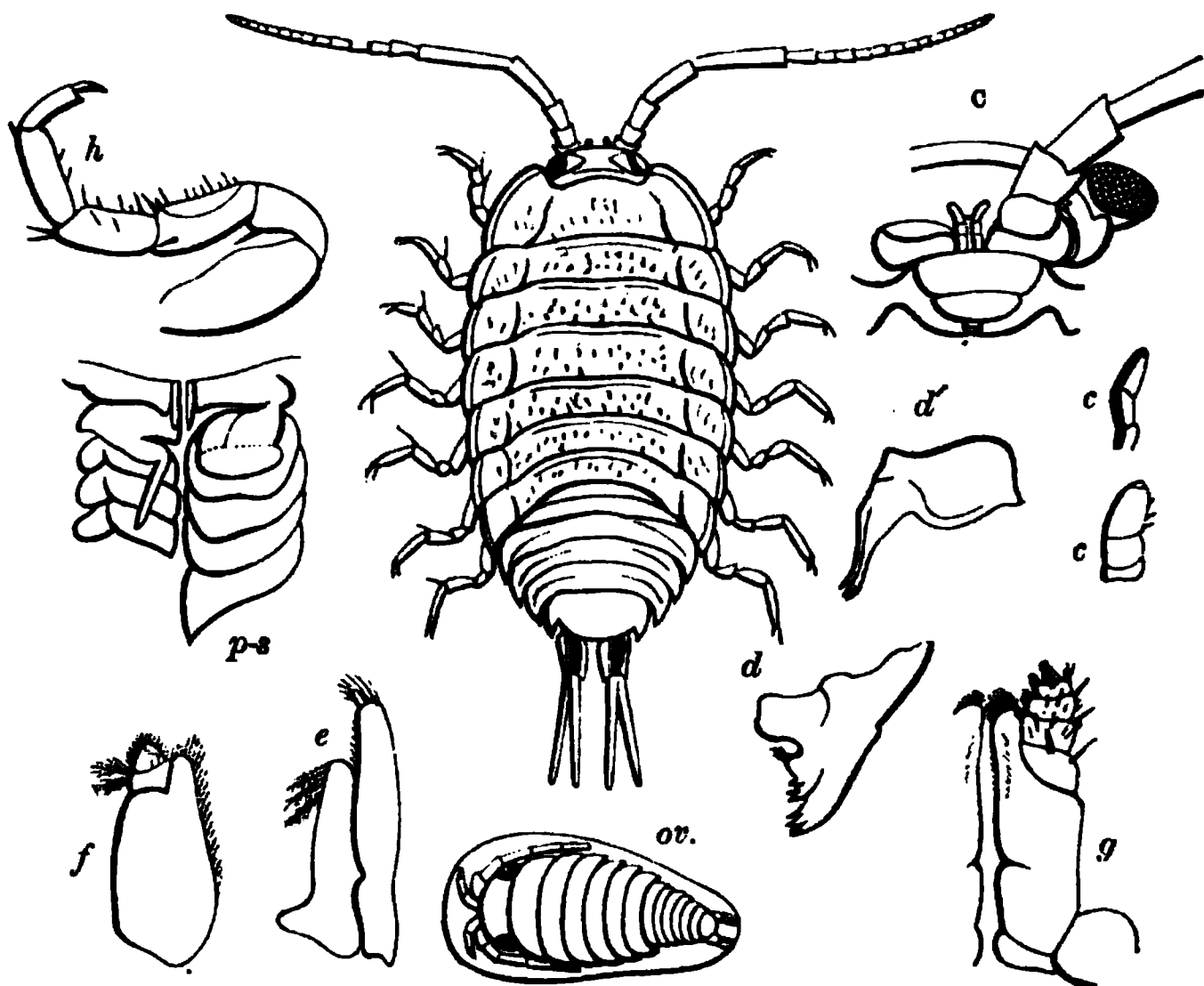
The body is oval and moderately convex, with the seven segments well developed, the lateral portions, consisting of the coxæ, or first joint of the legs soldered to the segments, being indicated by slightly impressed lines, nearly parallel with the lateral margins, and being nearly equally developed in all the segments. The tail consists of six segments, of which the two anterior are distinct on the middle of the back, but with the sides shortened and concealed by the posterior direction of the lateral extremity of the preceding segment of the body. The third and two following segments of the tail are free, and have their posterior angles acute; whilst the terminal segment has the posterior margin rounded, and on each side the posterior angle is produced to a tooth. The terminal pair of appendages are posteriorly exserted, and are more or less elongated in various species. The basal joint is truncated at its extremity, and furnished with a pair of elongated cylindrical rami of nearly equal length and size, the inner one terminated by a solitary strong hair.

The species are extremely active. They are very common on rocks just above high-water mark, hiding themselves in crevices of the rock and beneath stones with great agility.

ISOPODA.

NORMALIA.

ONISCIDÆ.



LIGIA OCEANICA.

Specific character. Somewhat depressed, oval, cephalon transverse, covered with smooth granulations. External antennæ with the flagellum fourteen-jointed, nearly glabrous. Last segment of pleon rounded posteriorly, with the lateral angles projected on each side. Terminal uropoda with the peduncle nearly as long as the last segment of the pleon.

Length, about one inch.

Oniscus oceanicus.

LINN. Syst. Nat. ii. p. 1061. PENNANT, Brit. Zool. (Edit. 1777), iv. t. 18, f. 4.

Ligia oceanica.

FABRICIUS, Ent. Syst. Suppl. p. 301. LATREILLE, Hist. Nat. Crust. et Ins. vii. p. 31. LEACH, Trans. Linn. Soc. xi. p. 374. Edinb. Enc. vii. p. 406. Enc. Brit. Suppl. i. p. 428. SAMOUELLE, Ent. Compend. p. 111. DESMAREST, Cons. Crust. p. 317, t. 49, f. 3-4. ROUX, Crust. Mediterr. t. 13, f. 8. MILNE EDWARDS, Crust. iii. p. 155. BRANDT, Bull. Mosc. vi. p. 172. WHITE, B. M. Cat. Brit. Crust. p. 71. Pop. Hist. Brit. Crust. p. 233,

pl. xiii. f. 1. KIMAHAN, Nat. Hist. Rev. iv.
279, pl. xx. f. 7-10. GOSSE, Man. Mar.
Zool. i. fig. 241.

Oniscus aquaticus.

BASTRE, Opusc. Subs. ii. t. 13, f. 4.

(Var.) *Ligia scopulorum*.

LEACH, Edinb. Enc. vii. p. 406. Linn. Trans.
xi. p. 374.

THIS is the largest British species in the family, from the rest of which it also differs by being found under stones, &c., in damp places on the shores of the ocean. It has the upper surface of the body slightly rugose, being covered with depressed granulations. The first segment of the body has a deep transverse impression immediately behind the head. The segments of the body have the lateral margins thickened, curved, and terminating behind in a rather sharp angle. The outer antennæ are about two-thirds of the length of the entire animal; they are robust, with the fourth and fifth joints much larger than all the rest. The flagellum differs in the number of articuli, probably on account of the difference in the ages of the different individuals. The upper lip is entire, and rounded at its free anterior margin. The lower lip, on the contrary, is very deeply incised in the middle, with the interior angles of the incision setose. The mandibles are strong, armed with two compound teeth, and with a strong incurved molar plate. In fig. *d'* the mandible is seen laterally, the inner tooth and plate not being visible from being on the same plane as the upper tooth. The inner maxillæ are formed of two terminal lobes, of which the outer is terminated by several strong straight bristles, whilst the inner is shorter, and armed with three deflexed setose bristles. The outer maxillæ have the two terminal divisions formed into two short joints, with two or three strong short bristles on the outside of the penultimate joint. The preceding portion has its inner apical angle produced into a setose fleshy lobe.

The terminal segment of the tail is longer, but narrower than the preceding. Its posterior margin is regularly rounded, whilst on each side the lateral posterior angle is produced into a strong tooth. The branchial apparatus consists of the five anterior pairs of the delicate membranous plates on the underside of the tail, through the centre of which a large artery passes to about two-thirds its length, sending off numerous branches that break up into a minute vascular network that spreads itself out over the entire surface. Of these plates the first pair is furnished, in the male, with a pair of minute linear styles at the inner angles. The second pair in the same sex is armed at its inner extremity with two long and nearly straight appendages, extending to the middle of the fifth pair. The terminal pair of these organs is formed into elongated appendages at the extremity of the body, of which the basal portion or peduncle is longitudinally elevated in the centre, but laterally depressed, oblong, with the posterior extremity narrowing. It articulates in a distinct notch of the posterior margin of the segment. The extremity of this basal portion is truncate, with the outer angle acute, and with the lateral lobe obsolete. It bears two filiform cylindrical appendages, which under a strong lens are seen to be furnished with minute regularly distant hairs. The inner is rather longer than the outer, and furnished at its extremity with a minute but strong hair.

The eggs and young are borne by the female beneath the body; the latter have only six segments of the body, and six pairs of legs, the seventh segment being rudimental, when they first quit the ovary.

The general colour is dull light green in the young male, with white spots.

The male is much larger than the female, and is generally of a paler and less varied colour.

The male organs consist of a pair of small styliform processes, centrally attached to the anterior or first segment of the pleon. These are connected by slender *ductus ejaculatorii* to a *vas deferens*, that suddenly enlarges and gradually diminishes to the extremity, where it divides into three testes, which enlarge, and gradually thin out with extreme delicacy. The external surface of the *ductus ejaculatorii* is marked by many small cells of black pigment.

This species is common on all our coasts, running with agility, and folding in the extremities so as to feign death. It indiscriminately feeds on decaying animal and vegetable substances, along tide-marks and rocks. It is seldom found under water, and may be observed running over the sand in full sunshine.

We have occasionally found them dead, yet standing on the rock as if they were alive and well. On examination, we have found that the branchial plates had been destroyed, probably by some insect, but of this fact we have no direct evidence.



Microscopical representation of the texture of the dorsal tegument of *Ligia oceanica*.

ISOPODA.

ONISCIDÆ.

NORMALIA.

Genus—PHILOSCIA. (*Latreille.*)ZIA. (*Koch.*)

Generic character. Ovate, sub-depressed. Cephalon rounded, not lobed. Inner antennæ minute, conical. Outer antennæ with cylindric joints, eight-jointed. Coxæ of sixth segment of pleon obsolete; first to fifth, narrow, linear. Uropoda entirely exserted; basal portion quadrilateral, transverse. Rami elongate, pointed at tip; outer terminating in a bundle of setæ; inner more slender, and extending beyond the middle of the outer ramus.

It is a curious circumstance that the animals of this genus, common as they are, and well described by Latreille and Zaddach, should have been unknown to Brandt, Lereboullet, and Milne Edwards, who have affirmed that the genus ought to be reunited to *Oniscus*, whereas it is in fact more nearly allied in several respects to *Ligia*. The typical species appears to have been figured by Koch under the name of *Ligia melanocephala*, which in his generic table he subsequently altered into the generic name of *Zia*, giving, however, fifteen joints to the antennæ, the flagellum being represented as composed of ten articulations.

The species are glossy, with the body flattened, and the head destitute of lateral or frontal lobes. “The inferior border of the frontal ring of the head is nearly straight across; the transverse suture well marked, nearly on a level with the superior margin of the external antennæ, its superior margin curved, raised, and passing slightly beyond the frontal line of the cephalic

segment, shutting out the orbit from the insertion of the external antennæ, and a deep sulcus separating it from the external angle of the orbit; the third ring being thus transverse and narrow. The second ring is nearly as deep as the third, and well marked; the epistomal narrow, and formed of two triangles placed apex to apex. The orbits are open below and behind."—Kinahan.

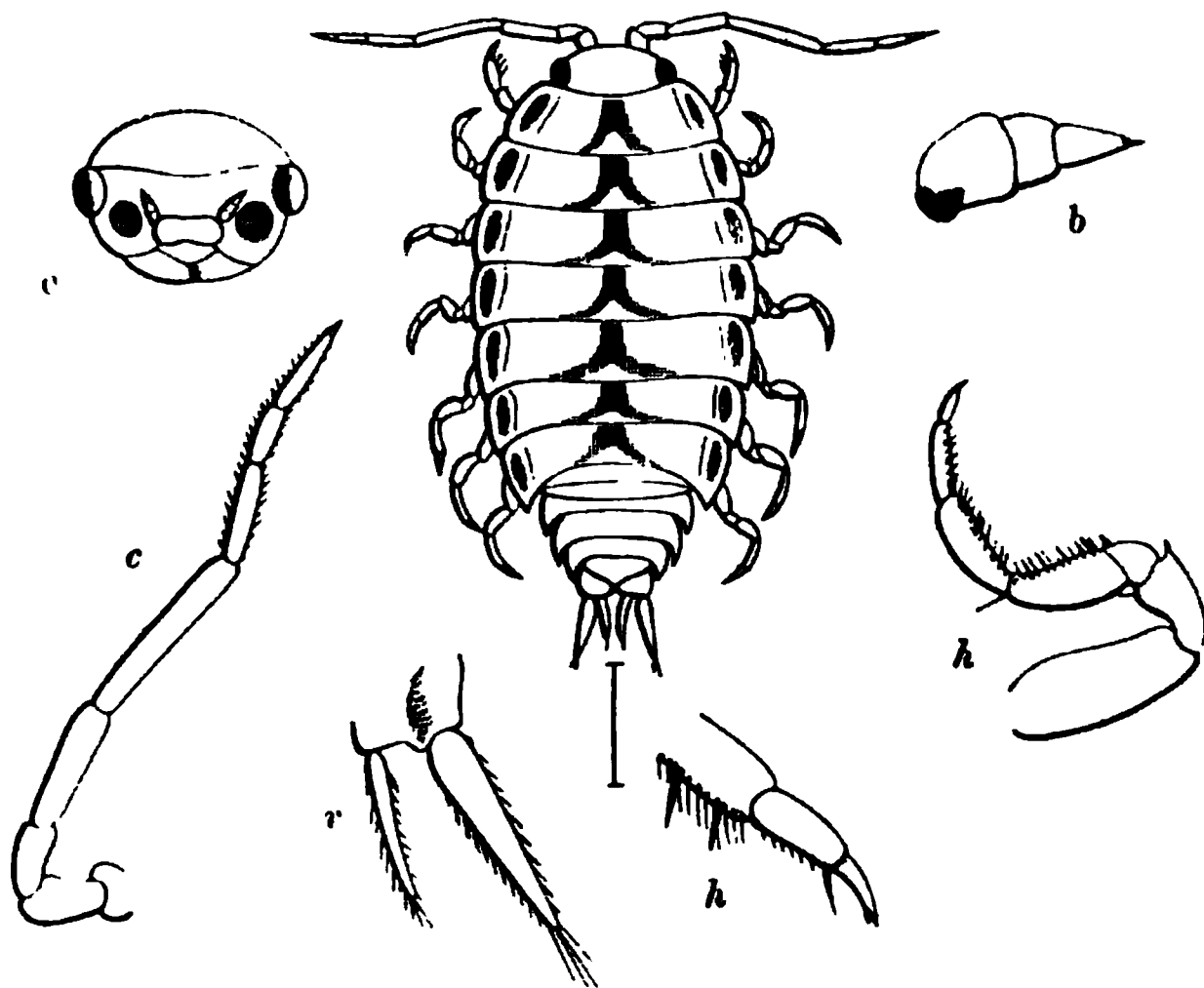
The inner antennæ are very small, conical, and three-jointed. The outer antennæ are cylindrical and eight-jointed, the three terminal joints forming the flagellum, which is tipped by a small short articulus. The legs have the lower margin of the intermediate joints armed with bristles; they are terminated by a very minute hook or finger, which is slightly bifid at its tip.

The two anterior segments of the tail are not produced into exserted lateral angles, as is the case with the three following. They are, however, narrower than the terminal segments of the body. The terminal segment is triangular, with the sides slightly emarginate for the insertion of the caudal appendages, which are elongated, and have the basal portion uncovered; the inner ramus of each is more than half the length of the outer.

The species are found in dry moss, at the roots of trees, and under leaves and stones. They run with great quickness, and do not hide away from the light. They do not attempt to roll themselves up into a ball, but feign death when alarmed.

ISOPODA.
NORMALIA.

ONISCIDÆ.



PHILOSCIA MUSCORUM.

Specific character. Smooth, shining; front of the cephalon slightly arched in the middle. Terminal segment of the pleon broadly triangular, apex acuminate, sides straight. Uropoda with the outer division falciform; the inner lobe scarcely more than half the length of the latter.

Length, one-fourth to one-third of an inch.

- Oniscus muscorum.* SCOPOLI, Entom. Carniol. p. 1145. CUVIER, in Journ. d'Hist. Nat. i. t. 26, f. 6, 7. COQUEBERT, Illust. Iconog. t. 6, f. 12.
- Philoscia muscorum.* LATREILLE, Hist. Crust. et Ins. vii. p. 43. Gen. Crust. et Ins. i. p. 69. LEACH, Trans. Linn. Soc. xi. p. 375. Edin. Enc. vii. p. 406. Suppl. Enc. Brit. i. p. 428. SAMOUELLE, Ent. Compend. p. 111. KINAHAN, Nat. Hist. Rev. v. 4, 1857, p. 280, pl. xx. figs. 1-6; v. 5, 1858, pp. 194, 195, pl. xxi. f. 4. WHITE, B. M. Cat. Brit. Crust. p. 72. Pop. Hist. Brit. Crust. p. 235. (Not the *P. muscorum* of Lereboullet, which is an *Oniscus*.)
- Oniscus sylvestris.* FABRICIUS, Ent. Syst. ii. p. 397.
- Ligia melanocephala.* KOCH, in Herrick-Schaffer Contin. of Panzer Ins. Deutschl. 162, 18; *ibid.* Deutschl. Crust. 22, 18.
- Zia melanocephala.* *Ibid.* sub. Ins. D. 180, 1, and D. Crust. 40, 1.

THIS species is smooth and shining, generally of a fulvous colour, with dark black patches and white spots. The head is transversely elliptical and arched in front, being destitute of any lateral or median lobe. The internal antennæ are small and inconspicuous; the outer antennæ are cylindrical and setose. The tail is much narrower than the terminal segments of the body, with the last ring broadly triangular, its apex being acute, and its terminal appendages having the outer division elongate-trigonate, spinous along its lateral margins; the inner lobe nearly as long as the latter.

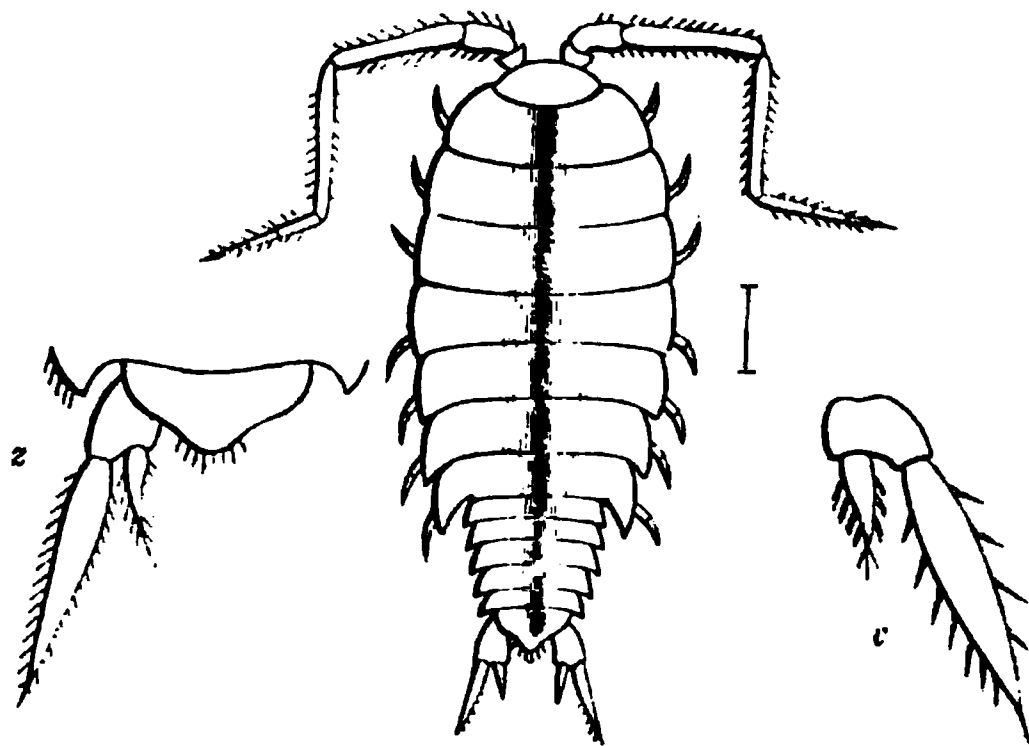
The species runs with great rapidity, and seeks the sunshine. It is widely distributed, and very common. It prefers dry rather than damp situations, under leaves, stones, and moss; also near the sea-shore. It is found abundantly throughout the southern part of England. Professor Bell found it under stones at Cheriton, and observes in his manuscript notes—"I found it of every shade of colour, from rich black to reddish brown and light green. It is more active than any other species, and the crust is more tender, and easily injured." Adding—"I believe colour to be absolutely valueless as a specific character in the whole of the *Oniscidæ*."

Dublin, Wicklow, Meath, Wexford, Cork, Waterford, and Tyrone, have been recorded as Irish localities.

ISOPODA.

NORMALIA.

ONISCIDÆ.



PHILOSCIA COUCHII.

Specific character. Smooth and glossy. Front of the cephalon nearly straight. Terminal segment of the pleon linear-triangular, with the apex obtusely truncate, armed with bristles, the sides slightly excavated. Outer ramus of the uropoda subulate-falciform; the inner not more than one-fourth of the length of the former.

Length, one-fourth of an inch.

Philoscia Couchii. KINAHAN, Nat. Hist. Rev. vol. v. 1858, p. 195, pl. 23, fig. 4.

THIS species was first described by the late Professor Kinahan, who gave the following characters of it:—"Body smooth, elliptical. Head somewhat rounded, nearly straight across the front; beneath the orbits is a small lobe arising from superior margin of the antennal ring.* Internal antennæ inconspicuous; external antennæ hairy. Tige (flagellum) long and narrow. Abdomen (tail) narrower than the cephalo-thorax (body). Telson (last segment) narrow, linearly triangular; apex rounded and

* "In the new species the frontal border of the carapace (cephalon) is carried well forward, and passes down to the antennæ, the superior antennal ring having its margin produced into a minute lobe beneath the orbit. This species fully proves the judiciousness of the separation of *Philoscia* from *Oniscus*."

fringed with stiff bristles, sides excavated. Posterior pleopods (uropoda) with the ischium (outer ramus) elongate, falciform, subulate. Accessory appendage (inner ramus) scarcely one-fourth the length of the ischium. In other respects as in *Philoscia muscorum*." The colour is lead-grey, and uniform to the naked eye.

The species runs with agility, but does not roll itself up into a ball. It was discovered at Talland Cove, near Polperro, from whence we were returning accompanied by Professor Kinahan, who gives this account of its discovery:—"In returning home we took the cliff road, and at Talland Cove spent a few moments examining the supra-littoral zone (the tide being nearly full in). Here, as might be expected, *Ligia oceanica*, *Porcellio scaber*, *Philoscia muscorum*, and *Orchestia littorea*, were abundant; but I was much pleased by also meeting with a *Philoscia* new to me, and also undescribed in the books. This I have named *Philoscia Couchii*, in memorial of one of the pioneers in the study of the zoological geography of England, and of a few pleasant hours spent in his company. The species appeared abundant, and the following description of the spot where it occurred may probably aid others in finding it:—Having descended the hill from Polperro, you cross the stream which drains an extensive osier marsh. The road then turns up a narrow ferny lane into a very heavy hill. Instead of turning up this lane, keep straight on from the bridge, and a few yards brings you up at the foot of the cliff. Here, amongst the loose stones and sea-weed carried up by the high tides into the clefts of the slate rocks, in company with the other *Oniscoids*, and many *Myriapods*, *Philoscia Couchii* will be seen hiding among the shingle, and easily distinguishable from *P. muscorum*, which also occurs, by its uniform colour."

ISOPODA.

ONISCIDÆ.

NORMALIA.

Genus—PHILOUGRIA. (*Kinahan.*)
ITEA.* (*Koch.*)

Generic character. Ovate, sub-depressed. Cephalon without frontal or lateral lobes. Outer antennæ nine or ten-jointed, with the second joint cylindrical; terminal joints subulated. Coxæ of first and sixth rings of pleon obsolete. Uropoda entirely exserted; basal portion trigonate. Outer ramus elongate, pointed, and exserted obliquely. Inner narrow, extending beyond the middle of outer, pointed.

THIS genus was first proposed by Zaddach, and subsequently adopted by Koch under the name of *Itea*—a name employed by Linnæus for a well-known genus of plants. Its description also was not sufficiently precise; whence Professor Kinahan was at first induced to consider the native species as undescribed, both generically and specifically. For both these reasons we consider ourselves warranted in adopting the generic name proposed by the lamented Irish naturalist.

The species are of comparatively small size, with the body smooth and shining. The limbs are armed with strong spines, generally arising from small conical tubercles. The structure of the front part of the head is nearly similar to that of *Philoscia*, but the lateral ridges around the insertion of the external antennæ are somewhat more strongly marked. The outer antennæ are entirely exposed at the base. The five basal joints constituting the peduncle are robust, spined, and gra-

* Nom. Gen. Plantarum.—LINN.

dually elongated to the fifth joint. The flagellum consists of four or five slender joints, generally terminated in a small pencil of setæ.

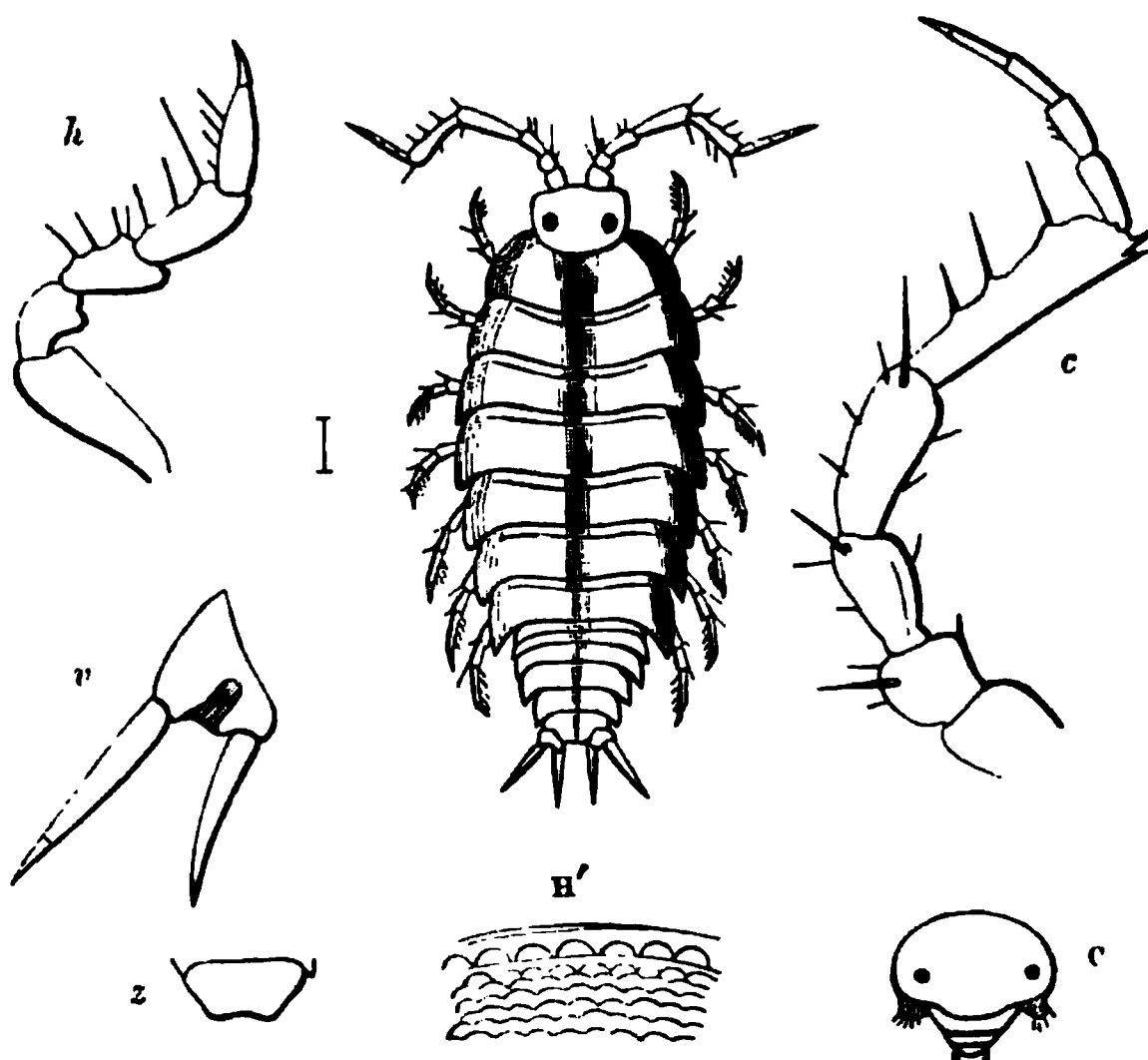
The body is elongate-ovate, and the tail is considerably narrower than the former, with the lateral-posterior angles of the second and three following segments prominent; and the terminal segment is broad and truncate at its extremity, with the terminal caudal appendages (uropoda) of considerable size, and partially covered, with the basal portion, somewhat triangular, affixed in a notch in the underside of the posterior margin of the terminal segment. The outer ramus is long and acuminate, terminating in a seta; the inner slender and acuminate, more than half the length of the outer.

The species are very active, and reside in damp situations, thus agreeing with *Philoscia*.

ISOPODA.

NORMALIA.

ONISCIDÆ.



PHILOUGRIA RIPARIA.

Specific character. Elliptical, smooth and glossy. Inner antennæ very minute and inconspicuous. Outer antennæ nine-jointed. Terminal segment of the pleon deeply emarginate on each side, truncate, triangular, with the extremity deeply emarginate.

Length, three-twentieths of an inch.

Itea riparia.

KOCH, in Cont. Panz. Ins. Deutschl. 162, 17; and Deutschl. Crust. 22, 17.

Philougria riparia.

KINAHAN, Nat. Hist. Rev. vol. v. 1858, pp. 197, 198, pl. 23, fig. 1.

Itea lævis (?).

ZADDACH, Syn. Crust. Prusa. p. 16.

Philougria celer.

KINAHAN, Nat. Hist. Rev. vol. iv. 1857, p. 281, pl. 22, figs. 1-4.

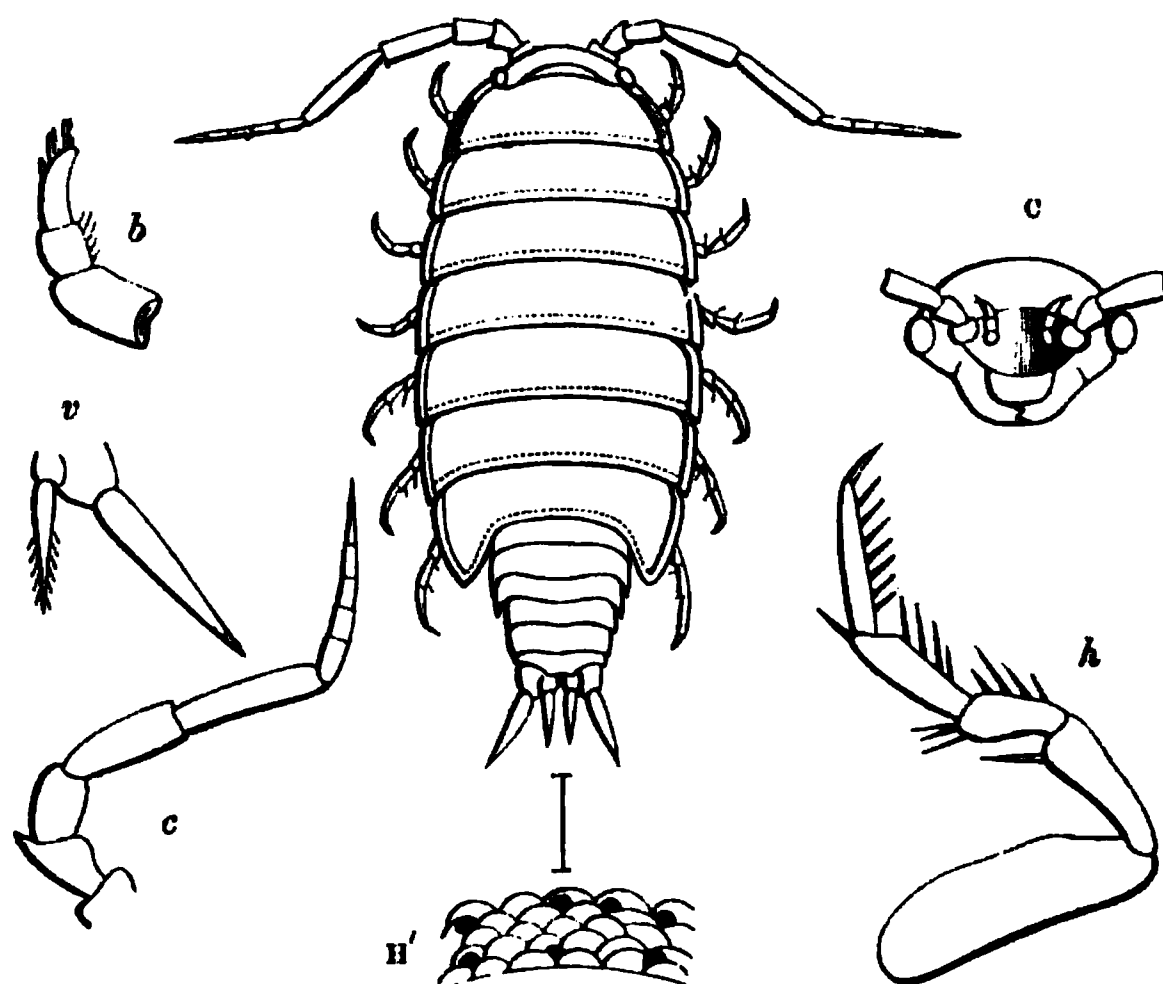
THE colour of this small species is uniformly claret-brown, appearing under a lens to be beautifully marbled with white. It is distinguished by its elliptical outline, and by the terminal segment of the tail being deeply

excavated over the insertion of the posterior pleopoda or terminal appendages; its middle portion is produced backwards, truncately triangular, and deeply emarginate at the tip. Under a lens the skin is found to be marked with minute semicircular incised lines, giving the appearance of a series of scales, as seen at Fig. H'. The outer antennæ appear to us to consist of only nine joints, the flagellum consisting of only the four terminal articulations.

This species appears to be widely dispersed throughout England and Ireland, although rare in the southern counties of the former. It has been taken near Dublin, Wexford, Cork, and Kerry by Dr. Percival Wright, and at Tyrone, Waterford, Portlaw, Kilkenny, and Wicklow (Prof. Kinahan). In Epping Forest and Chiselhurst, Kent; also at Plymouth; Polperro (in the gardens of the inn, not uncommon); Looe abundantly, among sticks by the river side. It is found in very moist places amongst all kinds of decaying matter, also amongst moist dead leaves, amongst wet ashes, and in moss, at the roots of trees. It runs with agility, buries itself deep in the ground, and generally congregates in numbers. It is very impatient of dryness, soon dying on exposure to air (Kinahan). It feigns death when disturbed, but does not attempt to roll itself in the least. Professor Kinahan found it with ova and young from February to November.

ISOPODA.
NORMALIA.

ONISCIDÆ.



PHILOUGRIA VIVIDA.

Specific character. Oval, smooth, glossy. Terminal segment of the pleon triangular, truncate, the extremity nearly straight, without any emargination; above, deeply sulcated. Outer antennæ ten-jointed. Colour brown, marked with small buff-white dots.

Length, five-twentieths of an inch.

Itea vivida.

KOCH, in Cont. Panzer Deutschl. Ins. 180, 4;
and Deutschl. Crust. 40, 4.

Philougria vivida.

KINAHAN, Nat. Hist. Rev. vol. v. 1858, pp. 197,
198, pl. 23, fig. 2.

Junior (?) Itea nana (?). KOCH, Opp. cit. 180, 5, and 40, 5.

THE general colour of this species is claret-brown, marbled with white when seen under a lens. It is of an oval form, smooth and shining, with the surface of the skin marked, in addition to the small fine curved scale-like appearance of the preceding species, with small scattered impressed dots or pits, as shown in Fig. h'. The

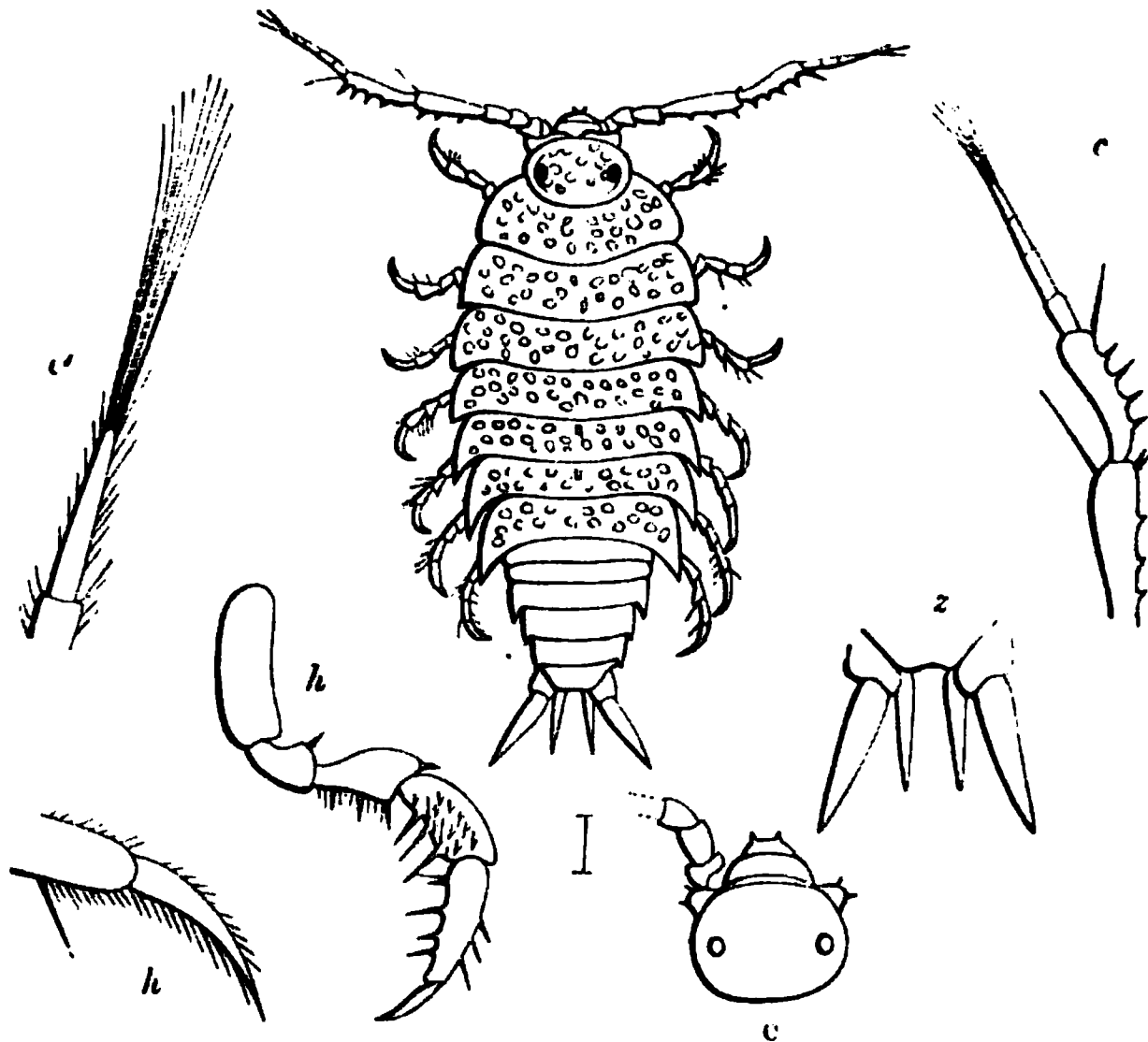
second joint of the outer antennæ is produced into an angle at its inner extremity, and the flagellum consists of five slender articuli. These organs are destitute of the spines which distinguish the other species. The terminal segment of the tail is triangular, truncate at the extremity, very nearly straight and deeply furrowed above, but not emarginate. The caudal appendages are trigono-subulate.

Taken not uncommonly under stones and moss on hills at Portlaw, in the county of Waterford, by Dr. Kinahan, in great abundance in March, 1858, even in the midst of snow. It runs with great agility, and does not bury itself deep in the earth like *Ph. riparia*.

ISOPODA.

NORMALIA.

ONISCIDÆ.



PHILOUGRIA ROSEA.

Specific character. Ovate, scabrous, covered with small tubercles. Eyes small. Inner antennæ conspicuous. Outer antennæ with the flagellum slender, with apparently only four articuli, which are very difficult to detect except under a strong lens; tipped with a pencil of hairs. Terminal segment of the pleon with the extremity truncated, straight. Colour reddish, with whitish spots and dorsal line.

Length, three-twentieths of an inch.

Itea rosea. KOCH, in Contin. Panzer Deutschl. Ins. 162, 16; and Deutschl. Crust. 22, 16.

Philougria rosea. KINAHAN, Nat. Hist. Rev. vol. v. 1858, pp. 197, 199, pl. 23, fig. 3.

THIS species is distinguished by its colour, which is of a clear minium-rose, with white dots, and with a white stripe down the median line, or (in specimens found in dark places) of a dead white, having a dark median line. The upper surface, except that of the posterior

segments of the tail, is tuberculated, each tubercle emitting a minute seta at its top. The eyes are small, black, and conspicuous. The inner antennæ are very conspicuous, extending beyond the front, and consisting of three joints with the tip setose; the outer antennæ are composed of five joints, besides the slender flagellum, which consists of four articuli, terminated by a long brush of hairs; the basal joints of these antennæ are armed with strong bristles arising from small triangular lobes. The lateral angles of the head beneath the orbits of the eyes are strongly marked. The terminal segment of the body is flat above, with the extremity truncate, and armed with several strong bristles.

We believe that this species has only hitherto been found in Mr. C. Spence Bate's courtyard and cellar, and that of neighbouring houses, at Plymouth, where it is tolerably abundant. Its habits agree with those of the rest of the genus, but it appears to frequent more humid haunts. It feigns death, but does not attempt to roll itself up, and is not quite so active as the other species.

ISOPODA.

ONISCIDÆ.

NORMALIA.

Genus—PLATYARTHURUS. (*Brandt.*)

Generic character. Flattened, broadly ovate, scabrous. Cephalon transverse. Lateral and frontal lobes strongly developed, arising from the anterior margin. Outer antennæ apparently six-jointed; second joint small; third short, narrowed outwardly at its base; fourth, ovate; fifth, largest, broad, flattened outwardly, but narrowed at its base; sixth, thin, pointed at the tip, with a slight indication of a joint at its base. Terminal feet with the basal portion large, exposed. Terminal portion as long as the basal, conical. Inner appendage slender, exserted.

THE type of this genus is closely allied to *Oniscus* and *Porcellio*, but differs in its short flattened antennæ, scabrous, perfectly opaque, white body, as well as in various minor structural details. The head has its anterior lobes arranged nearly as in *Armadillo*, being derived, according to Dr. Kinahan, from the cephalic, mandibular, or fourth ring of the head, and not from the third or second, *i.e.*, the antennary rings. The third is but badly developed and small, but the distinction between it and the fourth ring is evident.

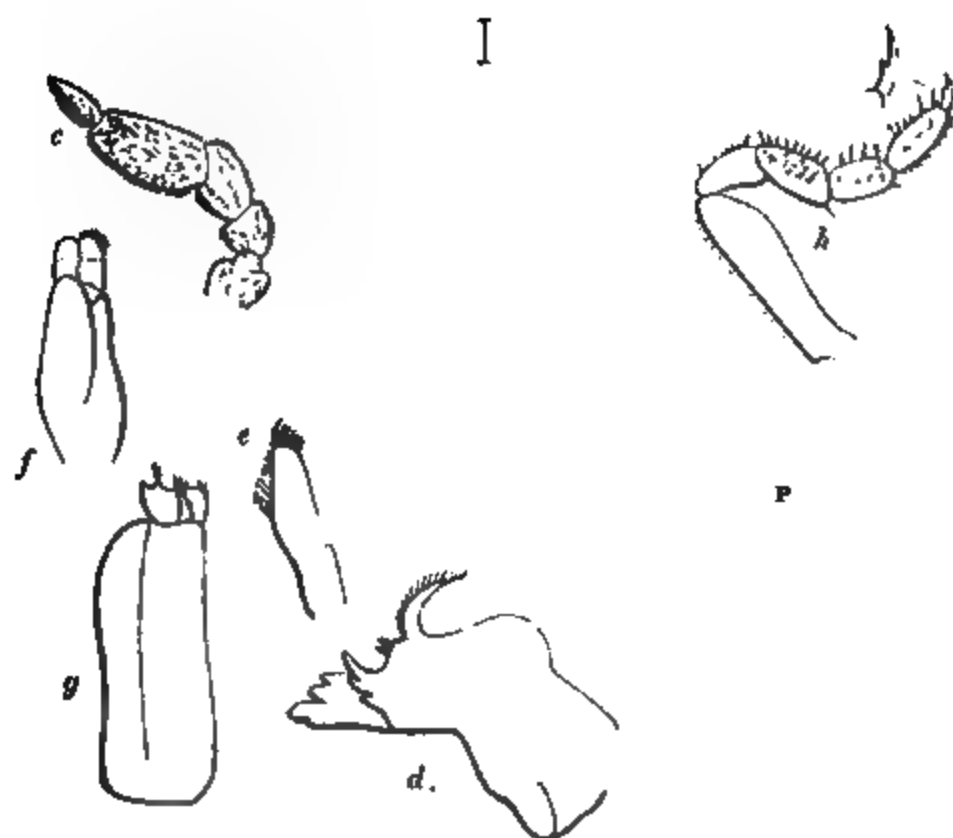
The internal antennæ are three-jointed and very minute; the outer antennæ are short but broad, flat, and scabrous, the fifth joint being much the largest, and dilated. We have not been able, with a powerful lens, to discover any articulation at the base of the terminal joint, as described by Dr. Kinahan, although a slight dilatation in the lateral margin near the base seems

to indicate the soldering together of two joints in that situation. The segments of the body are moderately convex, with a narrow lateral margin. The legs are short, with the second and three following joints of nearly equal size, terminated by a small hook-like finger, having a small tooth on the inside near the middle. The mandibles are strongly elbowed in the middle and terminated with two compound teeth, and furnished with a curved and setose spine in the middle of the inner margin. (In our woodcut the mandible is represented as lying on its back.) The two pairs of maxillæ are very delicate, almost membranous, and ciliated at the tips. The foot-jaws are oblong, flat, and coriaceous, each terminated by two small quadrate lobes, which are truncated at the extremity, where they bear one or two small spines.

The articulation between the posterior appendages and the last segment of the tail is very remarkable; the latter is destitute of the epimeral coxæ, and the ring is continued beneath, terminating abruptly on either side in a rounded lobe; so that the central portion of the body underneath is unprotected. The posterior pair of appendages are articulated to the anterior border of the inferior (sternal?) part of the ring, a little within the external lateral angle, by a well-marked ball-and-socket joint, so that at first sight it appears as though these appendages were derived from the penultimate and not from the terminal segment. The posterior appendages are exserted, the peduncular portion somewhat square, with the sides parallel. The outer ramus is nearly as long as the base, ovate, flattened, and pointed at the tip, where it is furnished with a minute filament. The inner ramus forms a slender filament, extending beyond the basal portion against the inner side: it is articulated near the base.

ISOPODA.
NORMALIA.

ONISCIDÆ.



PLATYARTHURUS HOFFMANNSEGGII.

Specific character. Opaque-white. Upper surface of the animal scabrous, with compressed scale-like club-shaped prominences. Posterior margins of the segments sub-serrated.

Length, one to one and three-quarters of a line.

Platyarthrus Hoffmannseggii. BRANDT, Bull. Soc. Nat. Moscow, vi. p. 174, pl. 4, fig. 10 (antenna, abeq. descr. specifica).

HOGAN, in Nat. Hist. Rev. vi. p. 109.

KINAHAN, in ditto, p. 127.

Itea crassicornis (?).

KOCH, in Contin. Panzer Ins. Deutschl. 186, fol. 5; and Deutschl. Crust. &c. 86, 5.

THIS curious little species has much the aspect of a *Porcellio*; it is, however, considerably broader in proportion to its size, the smallness of which, moreover, together with its opaque-white colour, broad short antennæ, sub-terrestrial and ant-loving habits, well distinguish it.

The head is broader anteriorly than posteriorly, deeply

immersed in the first segment of the body, and very scabrous; the lateral lobes are much developed. The antennæ are scabrous, as are also the segments of the body, the epimeral base of the legs forming the lateral margins of the segments, with the posterior angles directed downwards; the same part in the intermediate rings of the tail are also well developed; the terminal segment is triangular, emarginate on each side, with a shallow pit on its upper surface, its posterior margin tuberculated, as are also the posterior appendages (uropoda).

The species was first noticed as British by the Rev. A. R. Hogan, M.A., who found it in ants' nests at Lulworth Cove, near Weymouth, where he observed it in as many as thirty nests of the common red, yellow, and black ants, whilst about twice that number of nests in the neighbourhood were not found to be frequented by it. Previous to Mr. Hogan's discovery we had noticed the occurrence of these white *Oniscidæ* in the nests of the common brown garden ant at Hammer-smith, but thought they were merely the young of some species of *Porcellio*. Since that time Mr. F. Smith has also found the species in the neighbourhood of London, and we have also again met with it in ants' nests in the neighbourhood of Stow Wood, near Oxford, in the early summer months, as also at Berry Head, near Torquay, where they were found by Master M^cGuire Bate; and near Plymouth, taken by Mr. Brooking Rowe.

ISOPODA.

NORMALIA.

ONISCIDÆ.

Genus—ONISCUS. (*Linnaeus*.)

Generic character. Ovate, sub-depressed. Cephalon with large lateral lobes extending outwards beneath the eyes. Outer antennæ eight-jointed; second joint dilated at the base; seventh and eighth joints sub-confluent. Coxæ of the first, second, and sixth segments of pleon obsolete; third to the fifth, broad and curved, acute at tips. Terminal uropoda posteriorly exserted; apical portion ovate, pointed at tip. Inner lobe linear, short, extending slightly beyond the telson, which is convex.

THE species of this genus are typical of the family, commonly called wood-lice, and are distinguished from the other equally common species by having the terminal portion of the outer antennæ composed of three joints, of which, however, the articulation between the last and preceding joint is less distinct than the preceding.

The *Philosciæ*, which have also eight-jointed setose antennæ, are distinguished at once from the *Onisci* by the narrowness of the segments of the tail and the length of its exserted terminal appendages.

“The external angles of the superior margin of the third ring of the head are produced into a broad lobe, which covers over the origin of the external antennæ; it is then continued across, projecting slightly over the frontal line of the cephalic segment; the transverse suture is well marked; the second ring very narrow, almost obsolete. The lateral lobes are continued backwards, and are separated by a suture from the external

inferior border of the cephalic segment which completes the orbits." (Kinahan.)

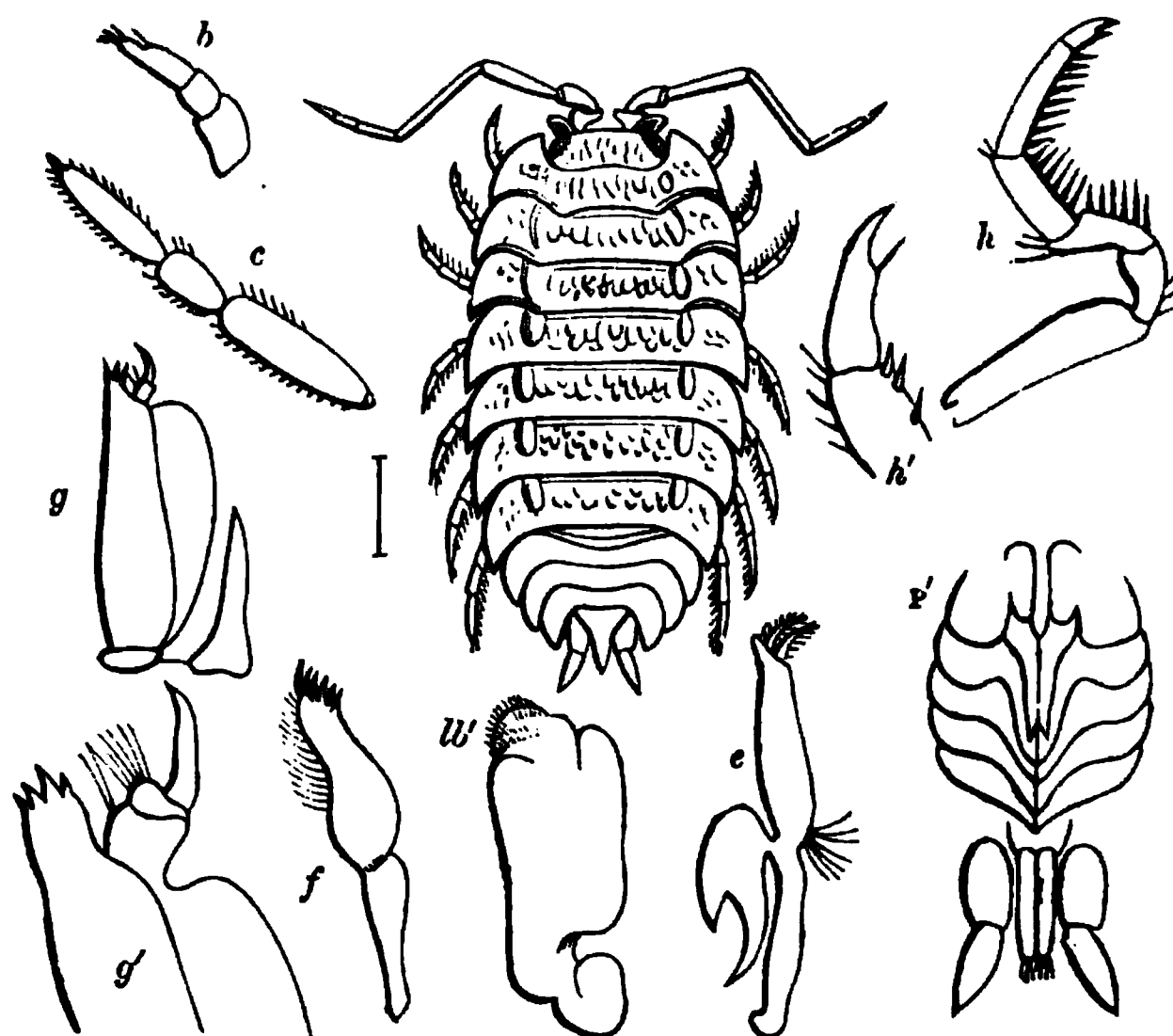
The structure of the mouth-organs is described under the typical species *O. asellus*. The first and second segments of the tail are visible only in the middle of the dorsal surface, the lateral margins of the third segment (of which the posterior angles are produced backwards, and acute) forms a continuous line with the lateral margins of the last segment of the body. The terminal segment is also narrowed at its base; and if we draw a line from its outer basal angles to the lateral angles of the two basal segments, we shall perceive that the lateral margins of the third, fourth, and fifth segments are produced outside of this line, and are strictly supplemental appendages or lateral lobes.

The extremity of the terminal segment is produced into a narrow and elongated point, its upper surface being convex, the basal portion of the terminal appendages extending to about half the length of this produced joint, of which the apex reaches the middle of the outer division of the appendage; the inner lobe of the basal portion is narrow and elongated, extending a short distance beyond the extremity of the tail.

The species frequent damp situations, and have not the power of rolling themselves into a perfect ball, but attempt to do this in an incomplete manner, feigning death when alarmed.

ISOPODA.
NORMALIA.

ONISCIDÆ.



ONISCUS ASELLUS.

Specific character. Broadly ovate, sub-depressed, shining; covered with smooth granules. Lateral lobes of the cephalon large, inclined backwards. Frontal line somewhat emarginate. Terminal segment of the pleon elongate-triangular, convex above. Intermediate segments of the pleon terminating in acute angles.

Length, three and a half to eight lines.

Oniscus asellus. LINK., Syst. Nat. ii. p. 1061. DE GEER, Ins. vii. t. 35, f. 1. GEOFFROY, Ins. Paris, ii. t. 22, f. 1. LATREILLE, Hist. Nat. Crust. et Ins. vii. p. 42. LEACH, Edin. Enc. vii. 406. SAMOUELLE, Ent. Compend. p. 111. JOHNSON, Syn. Framst. Sver. Onisc. p. 15. WHITE, B. M. Cat. Brit. Crust. p. 71. Pop. Hist. Brit. Crust. p. 284.

Oniscus murarius. CUVIER, in Journ. d'Hist. Nat. ii. t. 26, f. 11. FABRICIUS, Ent. Syst. Suppl. p. 300. BRANDT and RATZEB., Arzn. Thiere, ii. t. 12, f. 7. BRANDT, in Bull. Mosc. vi. p. 182. MILNE EDWARDS, Crust. iii.

p. 163. KINAHAN, Nat. Hist. Rev. vol. iv. 1857, p. 276, pl. xix. figs. 10, 11, 12, pl. xx. fig. 11, pl. xxi. fig. 5A. BURGERSDIJK, Annotat. p. 50. SCHNITZLER, Onisc. Agri. Bonn. p. 22.

THE upper surface of the animal is glossy and delicately punctured, as seen under a lens, the head and segments of the body being dorsally furnished with longitudinal raised spaces, leaving the posterior margin of each smooth. The head is received within a deep emargination of the anterior segment of the body, the anterior angles of which extend even in advance of the two prominent lateral lobes of the head. The inner antennæ are minute and three-jointed, the terminal joint being the longest and most slender, with a slight setose notch near the apex. The outer antennæ have the basal joint small, the second short, but broad and dilated at its base on the outside; the fifth joint is the longest, the three terminal joints being much more slender, and not more than two-thirds of the length of the fifth joint (in our magnified outline figure, *c*, the articulation between the two terminal joints is much too strongly marked); the tip of the eighth or terminal joint is furnished with a minute spine.

The labrum is membranous, and composed of two divisions, each of which is oblong in form, rounded at the extremity, where is a deep narrow notch or fold, the inner angle being somewhat more advanced, rounded off, and finely setose: the right-hand division is represented in figure *W*.

The mandibles are strong and horny, oblong in form, strongly angulated on the outside, the apex being at right angles with the base, and terminated by a compound tooth, with three or four short curved spatulated bristles along the margin, the inner angle of which is furnished

with a strong curved bristle, acute at the tip. The inner maxillæ are very delicate, and almost membranous, oblique at the tip, with two curved setose bristles, the base armed with two remarkable muscles. The outer maxillæ are narrowly oblong and rather curved, setose at the outer margin, and spinose at the tip; the foot-jaws are oblong, rounded on the outside, the external base armed with a strong triangular lobe; the apex is divided into two parts, the inner of which terminates in several small teeth, and the outer in a movable finger-like lobe, articulated at its base.

The legs are all cursorial, and are terminated by a foot having a small tooth on the inside.

The branchial appendages on the underside of the tail are arranged in pairs, the inner angle of the apical margin being more or less extended backwards; moreover, in the males, the second pair of these appendages are furnished at their base with a long style, dilated at its base, pointed, and slightly curved at its tip. The terminal pair of these limbs form the exserted biarticulated appendages seen on either side of the acuminate terminal joint of the tail; the two divisions of the last pair are nearly equal in length, the middle of the outer division extending to the tip of the tail. The internal accessory lobe of the basal portion is slender, and extends rather beyond the tip of the last joint of the tail.

The general colour of this species is of a light greyish brown or slaty lead, marked with blotches and spots of yellowish white or buff, of which the most conspicuous form a regular row on each side, parallel to the lateral margins of the segments, the margins being also pale with a dark spot; the dorsal spots are less distinct: a salmon-coloured variety, with dark patches, is stated by

Professor Kinahan to be occasionally met with near the sea.

This species is rarely found more than half an inch in length, but we possess a specimen, of unknown locality, measuring two-thirds of an inch. It is very common throughout England, Scotland, and Ireland, under decaying vegetable and animal matter, not only in damp, but in the driest localities. It is also common near the sea.

It was formerly used in medicine, and was supposed to cure agues, consumption, &c. It is commonly known under the vulgar names of Pig's-louse, Sows, Woodlouse, Millepede, or Carpenter.

ONISCUS FOSSOR.

Specific character. Oval, sub-depressed, covered with numerous rough granulations, which give it a powdered appearance. Cephalon convex. Lateral lobes moderate, rounded. Frontal line produced into a triangular lobe.

Length, five lines.

- Oniscus fossor.* KOCH, Dtsch. Crust. h. 22, n. 22 ; and in H. SCHAFFER, Contin. Panz. Faun. Ins. Germ. 162, fol. 22.
KINAHAN, Nat. Hist. Rev. vol. iv. 1857, p. 277, pl. xxi. figs. 5, 6, 7.
- Oniscus muscorum.* LEBREBOULLET, Mém. Strasbourg, iv. p. 29.
- Porcellio tæniola.* KOCH, Dtsch. Crust. h. 6, n. 2 ; and in H. SCHAFF. Cont. Panz. h. 139, n. 2 (var. ?).
- Oniscus tæniola.* Ibid. h. 180, n. 20, note, and fig. 6 (var. ?).

THIS species so closely resembles the preceding, that we have not considered it necessary to give a figure of it, which, indeed, without colours, would scarcely show its chief distinction, consisting in the much more

opaque upper surface of the body, which is finely punctured and furnished with the same kind of oblong tubercles found in *O. asellus*, but more numerous and closely arranged. The head also is more prominent. It is of a more uniform brownish-grey colour, although exhibiting the same kind of pale patches and rows of spots seen in that species. It also appears to be uniformly smaller than *O. asellus*.

We have adopted the reference to Koch's figure of *Oniscus fossor*, which Professor Kinahan states to be very characteristic, although the flagellum of the antennæ is only represented with two instead of three joints, as in the type of the genus.

This species inhabits dry places under stones and dry leaves. It is more active than the preceding species. It has been taken in Epping Forest and Chiselhurst, Kent, and near Dublin and Wexford, in Ireland. Specimens are in the British Museum, as well as in the Stephensian Collection of Crustacea at Oxford, purchased by the Rev. F. W. Hope, the latter being named *O. asellus*; and the Rev. A. M. Norman records it from Sedgefield, Co. Durham.

ISOPODA.

ONISCIDÆ.

NORMALIA.

Genus—PORCELLIO. (*Latreille.*)

Generic character. Ovate, sub-depressed. Cephalon with large lateral lobes. Outer antennæ seven-jointed. Coxæ of the second and sixth segments of pleon obsolete. Terminal uropoda with the basal portion triangular, flattened. Apical portion compressed, trigonate, exserted. Inner appendage small, curved, and trigonate, concealed by the last segment of the pleon, which is more or less concave on its upper surface.

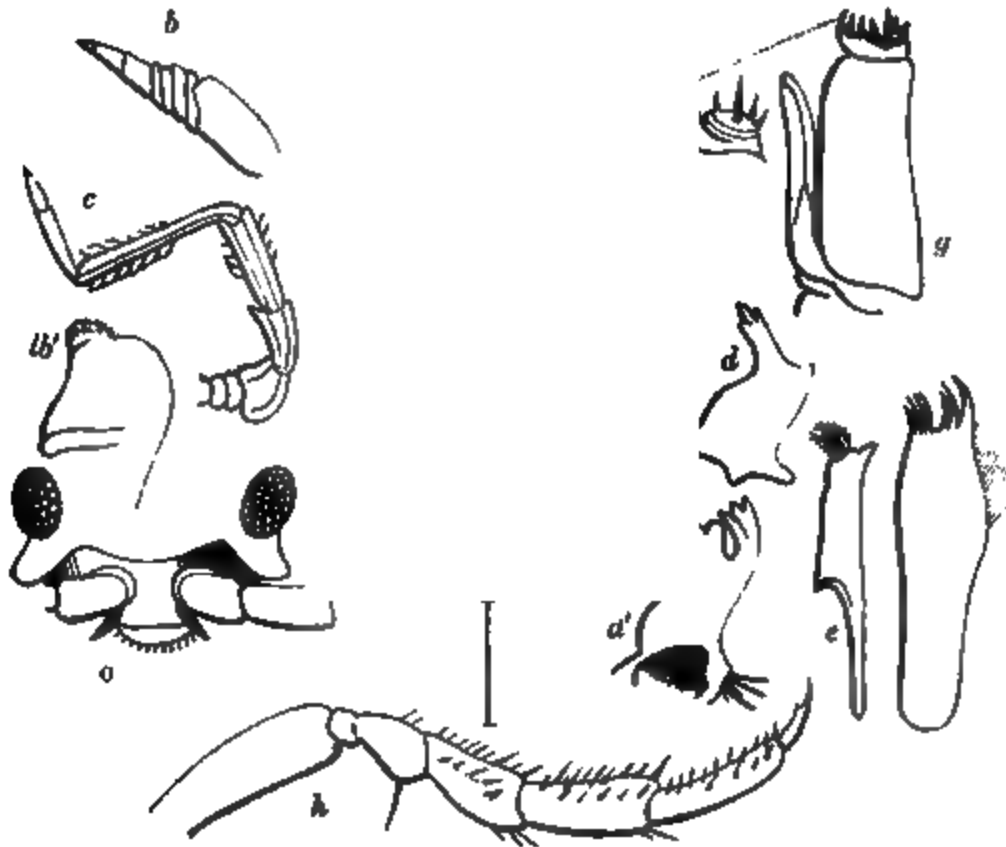
THE animals of this genus differ from those of *Armadillo* (which they resemble in having only seven-jointed outer antennæ), in the form of the second joint of those organs, which is not furnished with a rounded lobe on the outside at its extremity—a peculiarity dependent on the different arrangement of the front part of the head, and the consequent manner in which these organs are disposed when at rest, the remarkable groove at the sides of the front of the head being here wanting. The late Professor Kinahan thus described the structure of the front of the head in *Porcellio* :—

“External angles of the third antennary segment of the head more developed than in *Oniscus*, the superior margin raised into a lobe, which projects above the frontal line of the cephalic segment, and gives the head a trilobed appearance. This lobe, though sometimes badly marked (*Porcellio pruinosus*, Br.—*P. frontalis* Lereb., not Edw., for example), is present in all the species I have had an opportunity of examining.”

The inner antennæ are very minute and four-jointed, the second joint in some of the species appearing to be formed of several minute rings. The outer antennæ are seven-jointed, the basal joint also occasionally appearing as if formed of two portions. The base of the second joint is dilated; the fifth joint is long and somewhat slender, being considerably longer than the two terminal joints united. The details of the mouth-organs are described under *Porcellio scaber*, and need not, therefore, be here given. The elongation of the terminal appendages of the tail, to a considerable length beyond its extremity, also distinguishes these animals from *Armadillo*, the inner lobe of the basal support being even occasionally visible beyond the terminal joint of the tail.

ISOPODA.
NORMALIA

ONISCIDÆ.



PORCELLIO SCABER.

Specific character. Elongate-ovate, rugose. Lateral processes of the cephalon very prominent, with the external angle rounded. The middle process triangular. Last joint of the pleon ending in a sharp triangular point, deeply sulcated down the middle.

Length, nearly half an inch.

Porcellio scaber.

LATREILLE, Hist. Nat. Crust. et Ins. vii. p. 45. Gen. Cr. et Ins. i. p. 70. LEACH, in Trans. Linn. Soc. xi. p. 375. Edinb. Enc. vii. p. 406. Suppl. Enc. Brit. 1429. SAMOUELLE, Ent. Comp. p. 112. DESMAREST, Conn. Crust. p. 321. GUÉRIN-MÉNÉV. Icon. B. An. Crust. t. 31, f. 7. MILNE EDWARDS, Crust. iii. p. 167. CUVIER, Règne An. (Édit. Crochard), t. 71, f. 1. KINAHAN, Nat. Hist. Rev. vol. 4, 1857, p. 277, pl. xxi. figs. 2 and 8. KOCH, in Cont. Panzer Heft. 180, n. 6 and 7. WHITE, B. M. Cat. Brit. Crust. p. 72. Pop. Hist. Brit. Crust. p. 237, pl. xiii. fig. 2. BRANDT and HATZBURG,

- Arzn. Thiere, ii. tab. 12, f. 1, 2, 3, 4. JOHNSON, Syn. Framst. Sver. Onisc. p. 21. ZADDACH, Syn. Crust. Pruss. p. 12. BURGERSDIJK, Annot. p. 39. SCHNITZLER, Onisc. Bonn. p. 23.
- Oniscus granulatus.* LAMARCK, Hist. Anim. sans Vertèbr. v. p. 261.
- Porcellio dilatatus.* BRANDT and RATZEB., Arzn. Thiere, t. 12, f. 6. BRANDT, Bull. Moscow, vi. p. 176.
- Oniscus asellus.* FABRICIUS, Ent. Syst. Suppl. p. 300.
- Porcellio Brandtii.* MILNE EDWARDS, Crust. iii. 168 (var.).
- Porcellio dubius.* KOCH, in Cont. Panz. Heft. 180, n. 8.
- Porcellio affinis.* KOCH, in Cont. Panz. Heft. 180, n. 13 (var.).

THIS species is at once distinguished by the entire upper surface of the animal being strongly marked with round and elevated tubercles. The lateral lobes of the head are very prominent, and rounded at the outer angles, whilst the central lobe is strongly produced and nearly triangular. The animal is more or less ovate in form, and moderately convex, with the posterior angles of the segments of the body moderately produced and pointed. The outer antennæ have the second joint dilated internally at its base. The fifth joint is the longest, and the two terminal joints united are about two-thirds of the length of the fifth. The upper lip is formed of two flattened membranous plates, of each of which the outer apical angle is rounded, and the inner angle slightly extended, dilated, and setose. The right-hand division of this lip is represented in figure *lb'*. The mandibles are horny, strongly angulated on the outside, the extremity being at right angles with the base, and armed with three teeth, which seen laterally are obliquely truncated. Below this, the inner margin of the mandible beyond the middle is armed with a complicated series of short horny teeth and bristles, the innermost of which is elongated and curved. The inner maxillæ are delicate, and armed at the tip with two setose bristles; the outer maxillæ are large, oblong, setose on the outer edge, and

spinose at the tip. The foot-jaws are formed of a pair of large oblong plates, having an elongated horny support on the outside arising from their base. The extremity of each is furnished with a number of minute teeth, the inner ones arising from a distinct but very short lobe or division.

The terminal appendages of the tail are robust, with the outer division triangularly ovate, and extending about half its length beyond the extremity of the telson or terminal segment of the tail, which ends in a sharp triangular point, having a groove along the middle of its dorsal surface, and which completely covers and conceals the elongated accessory plate of the base of the apical appendages.

The colour of this species is uniformly of a greyish black or slaty grey, more or less strongly spotted with yellow ochre or whitish buff. A nearly uniform salmon-coloured variety also occurs, and it is very probable that others of the supposed species figured by Koch may be only varieties.

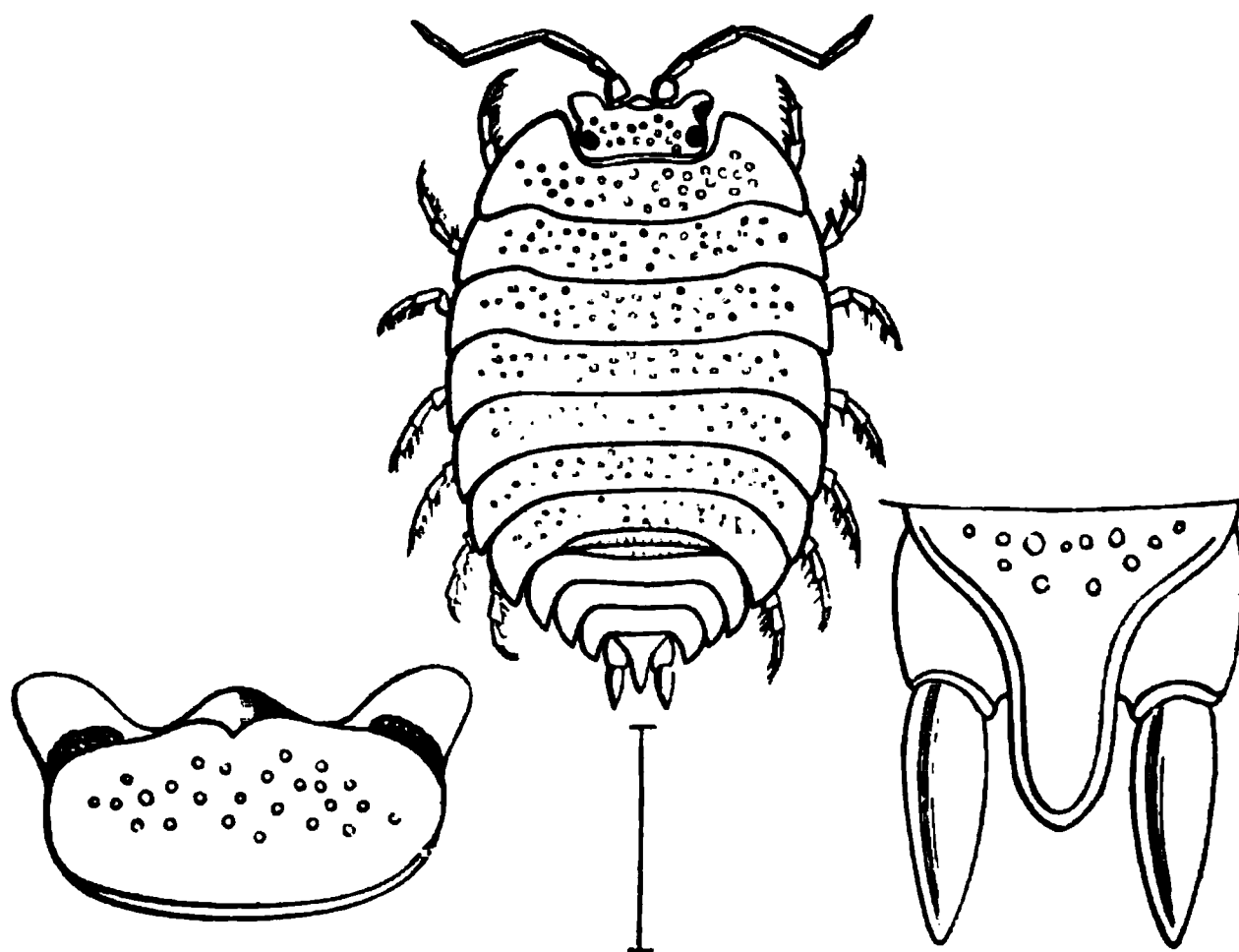
In *P. dubius* of Koch, the pale spots are wanting, the uniform colour being blackish. In his *P. affinis* there is a pale lateral line parallel to each side, running through the whole of the segments of the body.

The species runs with agility, and partially rolls itself into a ball when alarmed. It has been observed feeding on living caterpillars, frequenting moist places where decaying vegetation is found, and even among sea-weed, in company with *Ligia*, &c. We have also found it partial to growing vegetables, and it appears to possess a strong partiality for nearly ripe wall-fruit. It is very widely distributed throughout England and Ireland. The female may be found with eggs contained in the ventral pouch throughout the year.

ISOPODA.

NORMALIA.

ONISCIDÆ.



PORCELLIO DILATATUS.

Specific character. Very broad, depressed, rough, and granular. Lateral frontal processes very prominent, rounded at the apex, and concave. Median lobe obtusely triangular, moderately developed. Terminal segment of the pleon rounded at its apex, nearly flat above. Terminal plate of uropoda flat and broadly ovate, pointed at the tip.

Length, five to seven lines.

Porcellio dilatatus. BRANDT, Bull. Mosc. vi. p. 176. BRANDT and RATZBURG, Arn. Thiere, ii. pl. 12, f. 6. BURGERSDIJK, Annot. p. 44. KINAHAN, Dublin Nat. Hist. Rev. vol. 4, 1857, p. 278. SCHNITZLER, Onisc. Bonn. p. 23.

Porcellio scaber. MILNE EDWARDS, Crust. iii. p. 167.

THIS species is ordinarily much larger than *P. scaber*, from which it is easily distinguished by its very broad form, and by the less scabrous surface of its body. The outer antennæ are rather short, with the two terminal

joints of nearly equal length. The lateral lobes of the front of the head are large, and curved rather outwards; they extend rather beyond the anterior angles of the first segment of the body, which, together with the two or three following segments, are marked with rather oblique and slender lines and rugosities. The terminal segment of the tail has the sides of the apical half nearly parallel, and the tip itself rounded.

It is of an uniform slaty-grey colour, with faint irregular pale lines and spots indicating the chief rugosities.

It is found amongst decaying grass and straw, and appears to be extremely rare. It crawls very slowly, and partially rolls itself into a ball. It is very brittle in its texture, a touch causing the limbs to fall off.

Specimens are preserved in the British Museum, found by Prof. Kinahan, from the neighbourhood of Dublin.

ISOPODA.

NORMALIA

ONISCIDÆ.



PORCELLIO PICTUS.

Specific character. Slightly elongated, moderately granulated, upper surface glossy. Lateral lobes of the cephalon very prominent, curved outwards and downwards; the median lobe small and curvilinear. Terminal segment of the pleon triangular, acute at the apex, sulcated above.

Length, about one-third of an inch.

Porcellio pictus.

BRANDT and HATZBURG, *Arane-thiere*, ii. pl. 12, f. 5. *Conspect. Mon. Onisc. Bull. Mosc.* vi. p. 176. MILNE EDWARDS, *Crust.* iii. 166. КИНАН, *Dublin Nat. Hist. Rev.* vol. 4, 1857, p. 278. JOHNSON, *Syn. Framst. Sver. Onisc.* p. 22. BURGESS, *Annot.* p. 46.

(Var.) *P. serialis.*

KOCH, *Cont. Panz. Heft.* 180, n. 18.

(Var.) *P. crassicornis.*

KOCH, *Cont. Panz. Heft.* 180, n. 19.

(Var. ?) *P. conspersus.*

KOCH, *Cont. Panz. Heft.* 180, n. 17. ZADDACH, *Syn. Crust. Pruss.* p. 12 (?).

Porcellio melanocephalus.

SCHNITZER, *Onisc. Bonn.* p. 24 (and KOCH ?).

FINELY-MARKED specimens of this species are amongst the handsomest of the British Isopods. The general

form of the body is that of *P. scaber*, but the comparatively small amount of granulation of the upper surface, with the short triangular terminal segment of the tail pointed acutely at its tip, will serve to distinguish it, independent of its coloration and marking.

The head is entirely black and strongly granulated, the granules of the hind part of the head being arranged in transverse rows; the ground colour of the remainder of the animal is that of yellowish clay. The anterior half of the first segment of the body has a black streak extending down the middle, on each side of which is a bright yellow patch, with a black spot on each side behind the eyes. These spots reappear in the following joints, the central black one being widened, and the yellow one on each side nearly forming a ring, enclosing a dark spot and some dark dots; the lateral margins are yellow, with groups of black dots near the edges, and a sub-marginal black streak on each side parallel with the margin. The basal portion of the apical appendage of the tail is yellow, and the broad outer division black, with the tip pale. The outer antennæ are dusky, the sixth joint being evidently longer than the terminal one.

The several varieties above quoted, given as distinct species by Koch, vary in the greater or less clearness of the dark longitudinal stripes down the back; in *P. serialis* these dark stripes alternate in nearly equal width with the intervening pale ground of the body, leaving in fact a pale central and two narrow streaks parallel with the sides of the body, together with a broader or less clearly defined one on each side of the dark lines at the edges of the central pale one.

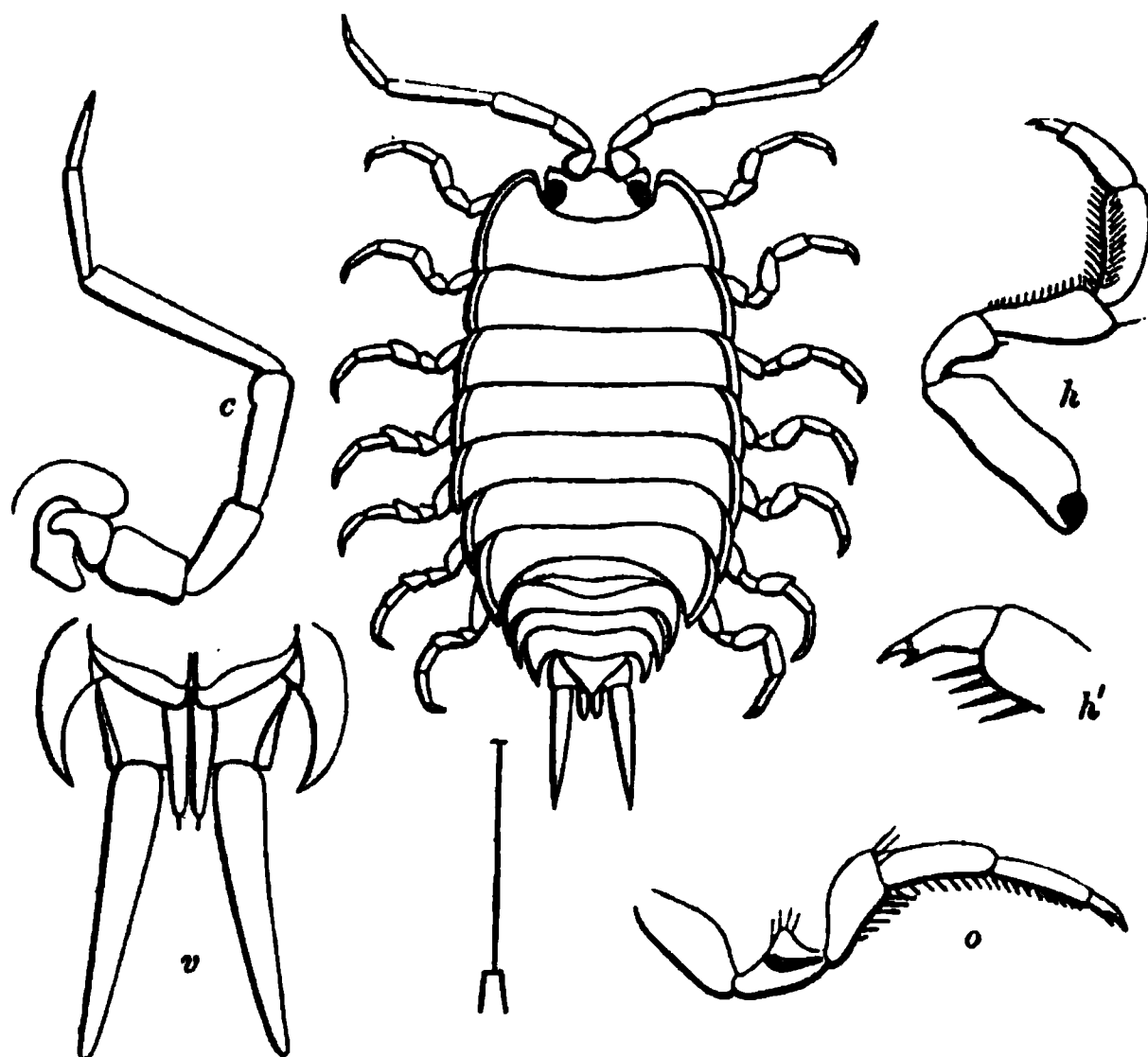
In its general form and appearance it resembles *Oniscus fossor*, from which it however differs in being far more glossy and variegated in colour.

It appears to affect dry situations, such as the rubbish in old ruins, and under dry leaves. It runs with great agility, and does not roll itself into a ball.

The neighbourhood of Dublin and Belfast in Ireland, and Chiselhurst in Kent, in England, have been recorded as the localities of this species; in the latter situation it was found in chalk pits.

ISOPODA.
NORMALIA.

ONISCIDÆ.



PORCELLIO LÆVIS.

Specific character. Very convex, smooth. Lobes of the sides of the front of the cephalon slightly prominent, small, and rounded at the outer angle; middle lobe very short. Terminal segment of pleon rounded at the tip, deeply sulcate down the middle. Uropoda considerably elongated.

Length, three-quarters of an inch.

- Porcellio lævis.* LATREILLE, Hist. Nat. Crust. et Ins. vii. p. 46; Gen. Cr. et Ins. i. p. 70. LAMARCK, Anim. s. Vertèbr. t. 5, p. 154 (*Oniscus* L.). MILNE EDWARDS, Crust. iii. p. 169. KINAHAN, Nat. Hist. Rev. vol. iv. 1857, p. 278. WHITE, B. M. Cat. Brit. Crust. p. 72. Pop. Hist. Brit. Crust. p. 237. JOHNSON, Syn. Framst. Sver. Onisc. p. 27. ZADDACH, Syn. Crust. Pruss. p. 13.
- Cylisticus lævis.* SCHNITZLER, Onisc. Agri Bonn. p. 25.

THIS is the largest British species of the genus, and is well distinguished by the smooth upper surface of the animal, the small lateral lobes of the face, and the great

length of the two terminal appendages of the tail. Herr Schnitzler has, indeed, proposed to form it into a separate genus, *Cylisticus*, on account of the convexity of the terminal segment of the tail, the rectangular lateral termination of the segments of the body, and the curious character (to which he has first directed our attention) that each of the false feet, or branchial plates of the tail, are marked with small white spots at the base; whereas in the other species it is only in the first and second pairs of those organs that this character is to be found. These characters do not appear to us, however, to be of sufficient importance to warrant the establishment of a new genus for the *P. lævis*.

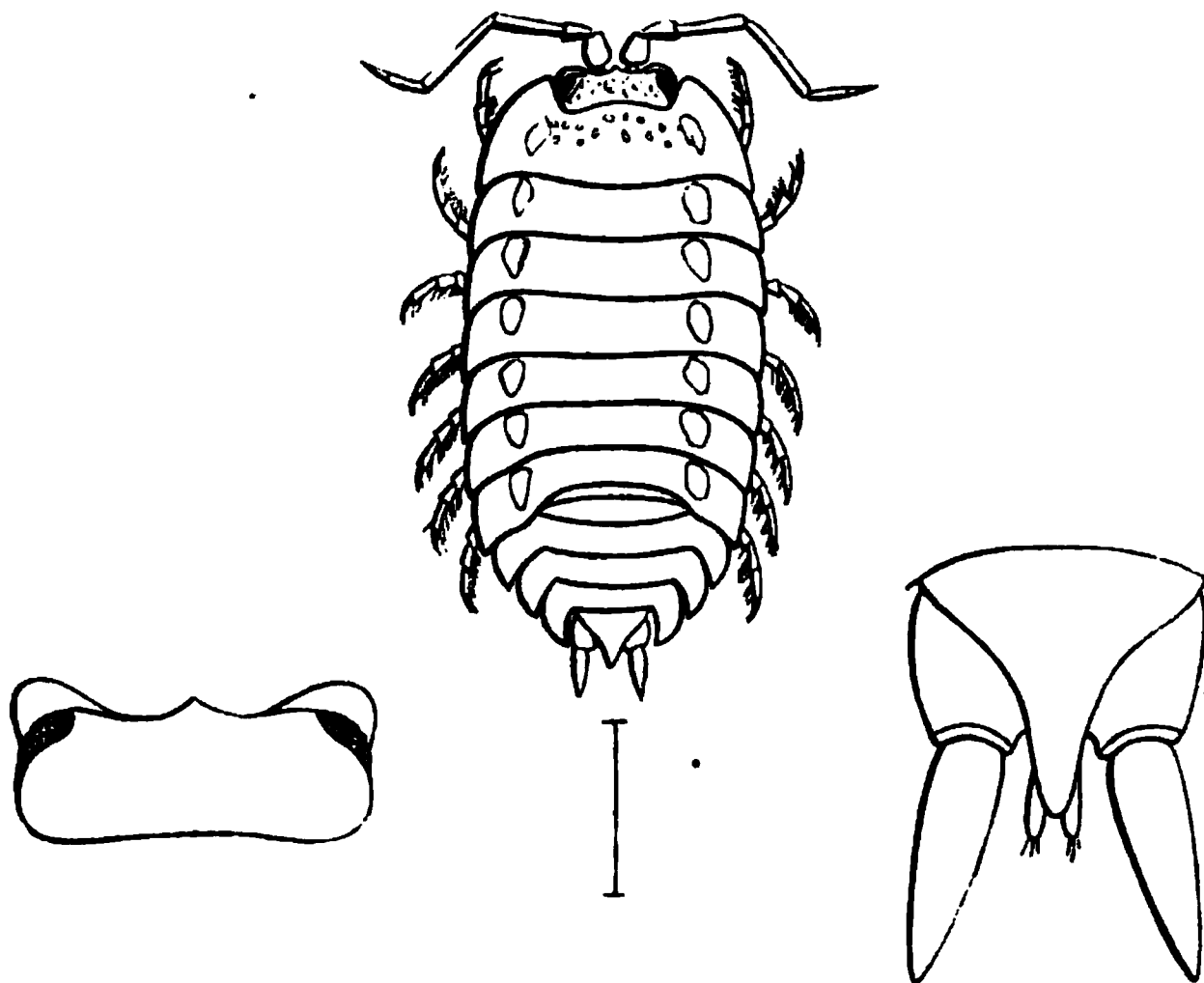
Its colour is of a leaden grey, occasionally blotched with yellow on the sides. It is sluggish in its habits, and occurs commonly in stable-litter, and among grass at the bottom of walls.

It occurs in England and Ireland. Kent, and the neighbourhood of London and Dublin, have been recorded as the localities.

ISOPODA.

ONISCIDÆ.

NORMALIA.



PORCELLIO ARMADILLOIDES.

Specific character. Elongate-elliptical. Segments very convex and smooth. Lateral lobes of the front of the cephalon minute, obliquely truncated in front. Central lobe very short, angular, and acute. Terminal segment of the pleon acute, flat above, or slightly convex.

Length, half an inch.

Porcellio armadilloides. LEBEBoullet, Mem. Soc. Nat. Hist. Strasbourg, iv. 1853. KINAHAN, Dublin Nat. Hist. Rev. iv. 1857, p. 279.

Oniscus convexus. DE GEER, Mem. Ins. vii. p. 553, pl. 35, f. 11.
JOHNSON, Syn. Frana. Sver. Onisc. p. 32.

Oniscus saxatilis. HARTMANN.

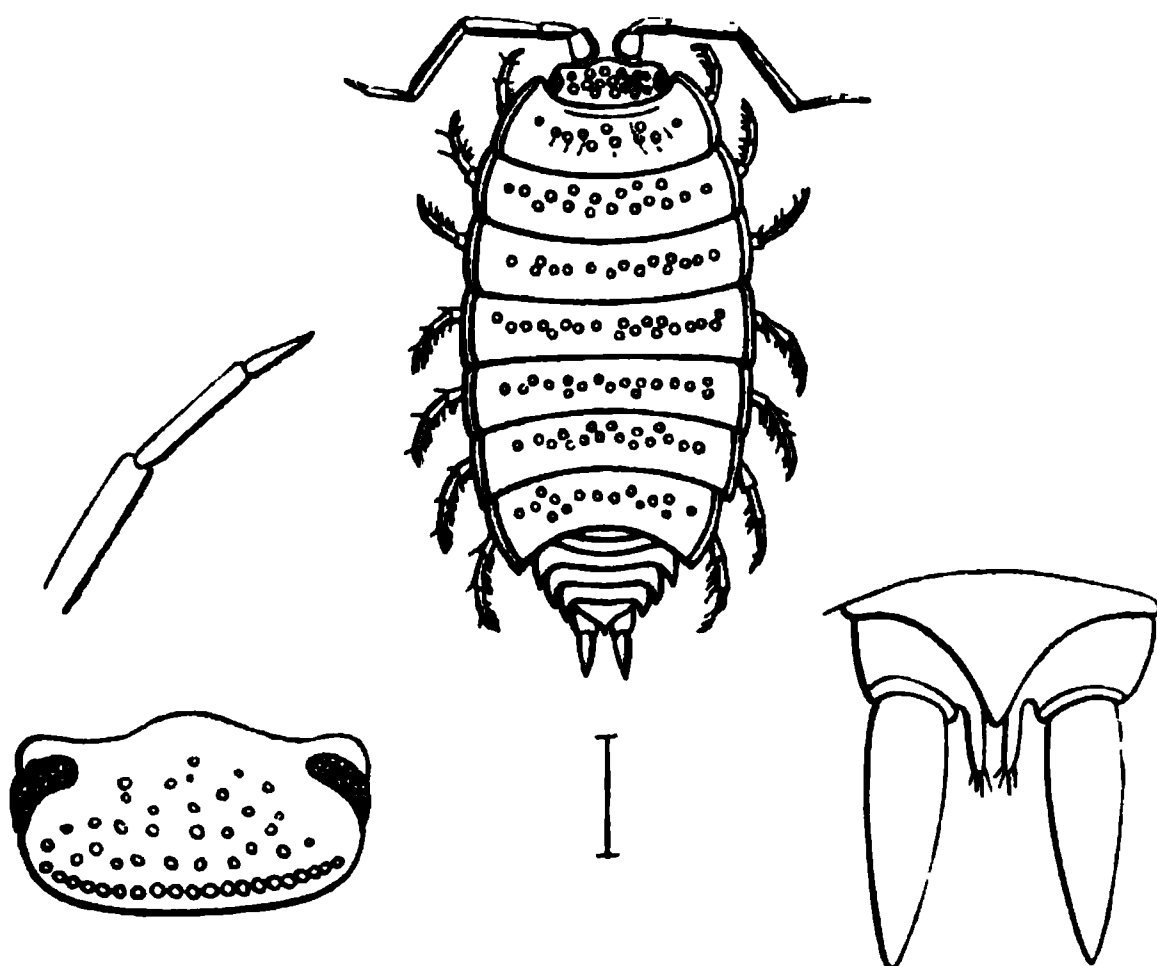
THIS species is well distinguished by its narrow and almost cylindrical form, reminding the observer strongly of the species of the genus *Armadillo*. The lobes of the head are but slightly developed, the lateral ones having a

rounded margin and a concave upper surface. The segments of the body have the posterior angles acute. The third, fourth, and fifth segments of the tail are largely developed, their lateral margins being continuous with that of the sides of the body-segments. The terminal segment of the tail is elongate-conic, and pointed at the tip, with the upper surface slightly convex, and extending to about one-third of the length of the outer division of the terminal appendages of the tail, which are elongate, slender, and pointed at the tip. The general colour is iron-grey, with clear borders to the segments, and with a row of ill-defined whitish spots on each side of the body, parallel with the lateral margins. When alive, it rolls itself into a perfect ball on being alarmed.

Specimens taken near London (at Highgate ?) by Mr. Francis Walker, are in the cabinet of the British Museum.

ISOPODA.
NORMALIA.

ONISCIDÆ.



PORCELLIO PRUINOSUS.

Specific character. Subovate, oblong, slightly rugose, and downy. Lateral lobes of the front of the cephalon small and rounded. Central lobe minute, almost linear. Pleon narrow, with the terminal segment triangular, acute at the apex. Pereiopoda long.

Length, about one-third of an inch.

- Porcellio pruinosus.* BRANDT, Conspectus Mon. Onisc. Bull. Mosc. vi. p. 181.
KINAHAN, Dublin Nat. Hist. Rev. vol. iv. 1857,
p. 278, pl. 19, figs. 3, 5, 7, pl. xxi. fig. 1.
- Porcellio frontalis.* LEBREBOULLET, Mem. Soc. Hist. Nat. Strasbourg, iv.
1853 (not of MILNE EDWARDS). JOHANSSON, Syn.
Framst. Sver. Onisc. p. 30.
- (Var.?) *P. maculicornis.* KOCH, Cont. Panz. Heft. 180, n. 16. BURGERSDIJK,
Annot. p. 48.

THIS species, although one of the commonest of our British wood-lice, was first detected by the late Professor

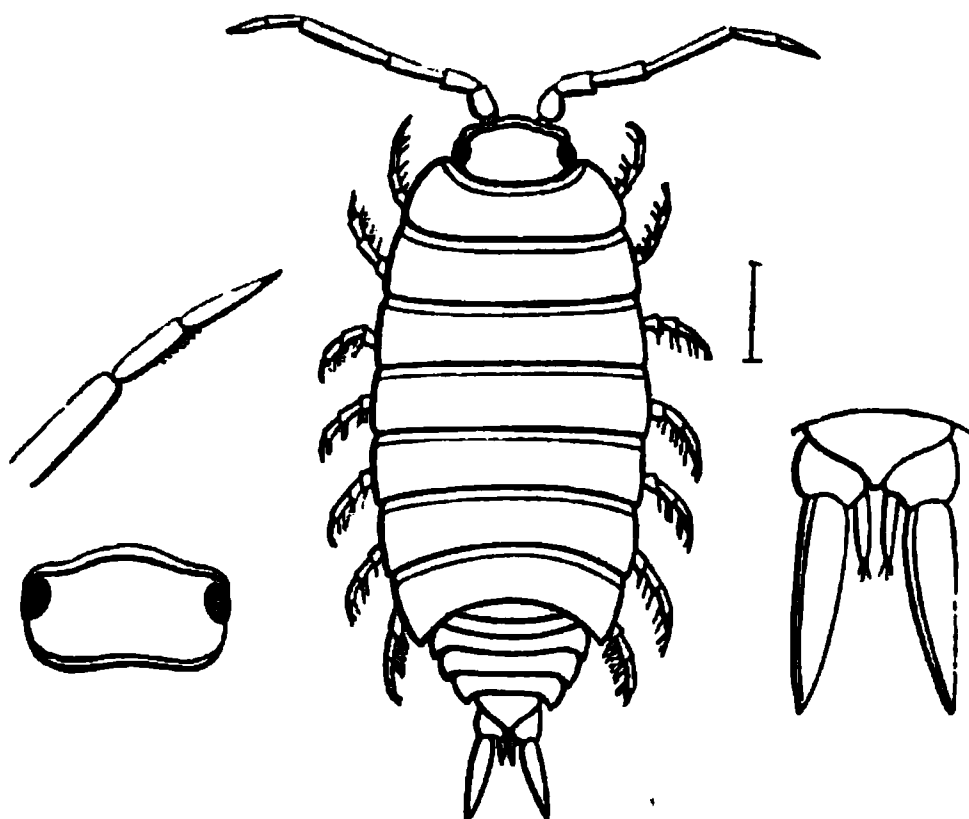
Kinahan, having been confounded with *P. scaber*, from which, however, it is at once distinguished by its more elongate form, less rugose surface, and especially by the narrowness of the tail, in which respect it approaches the species of the genus *Philoscia*. The posterior angles of the three anterior joints of the body are obtuse, and those of the following joints are much less acutely produced backwards than in most of the other species of the genus. The lobes of the head are but slightly produced, the central one being small and rounded. The tail is small, the three principal segments being comparatively minute, as compared to their size, in the preceding species. The terminal joint is short and triangular, its extremity only extending a little beyond the base of the terminal division of the apical appendages of the tail, which is considerably elongated, as are also the legs; the whole structure of the animal indicating greater activity and powers of movement.

The variety *P. maculicornis* of Koch is of an iron colour, with the outer antennæ ringed with white, the segments of the body having the posterior margins simply granulated, and the terminal appendages of the tail of a ferruginous colour.

The species is of an uniform mouse-grey colour, seen under a lens to be marked with white. It generally conceals itself rapidly from the light, but, when disturbed, runs with great rapidity. It prefers moderately humid warm situations, and occasionally buries itself in the earth, even in clayey localities, to a considerable depth. It is very common both in England and Ireland. The neighbourhoods of Dublin and Chiselhurst, Kent, are localities in which they are found. It is equally plentiful in the vicinity of Oxford.

ISOPODA.
NORMALIA.

ONISCIDÆ.



PORCELLIO CINGENDUS.

Specific character. Elongate-ovate, smooth or but slightly scabrous, glossy. Lateral lobes of the front margin of the cephalon minute and deflexed; the median one nearly obsolete. Terminal segment of the pleon broadly triangular, flat above, with the apex acute.

Length, nearly one-third of an inch.

Porcellio cingendus. KINAHAN, Dublin Nat. Hist. Rev. vol. iv. 1857, p. 279, pl. xix. figs. 1, 2, 4, 6, 8, and 9.

THE minute development of the lateral and frontal lobes of the anterior margin of the head, the narrowness of the segments of the tail, and the broadly triangular terminal segment of that part of the animal, well distinguish this species from most of its congeners; whilst the smooth shining body, and the rounded postero-lateral angles of the segments of the body, serve to separate it

from *P. pruinosis*, in company with which it is often found, and of which it might be mistaken for the young, which latter, however, do not differ from their parents. The basal portion of each of the segments of the body is marked with a transverse raised line, whence the name given by Professor Kinahan to the species. It is of a dark steel colour, with red and yellow spots. It runs with very great rapidity, and never rolls itself into a ball, as might indeed be surmised from the small development of the lobes of the head, which form, in other species, the defence of the antennæ when at rest.

It is very rare. Specimens taken near Dublin by Professor Kinahan, are in the collection of the British Museum and our own cabinet.

ISOPODA.

ONISCIDÆ.

NORMALIA.

Genus—ARMADILLO. (*Latreille.*) *ARMADILLIDIUM. (*Brandt.*)

Generic character. Elliptical, very convex. Outer antennæ seven-jointed. Coxæ of the first and sixth segments of the pleon obsolete. Uropoda with the basal portion flattened, truncate; terminal portion broader than long, not extending beyond the extremity of the pleon, with which its apical margin forms a continuous line: accessory filament flattened, club-shaped, concealed.

THIS genus forms a distinct section of the family on account of the structure of the last pair of the appendages of the tail, which do not extend beyond the extremity of that part of the body, their truncated extremity forming a continuous line with the lateral margin of the fifth segment of the tail, and the extremity of the sixth joint.

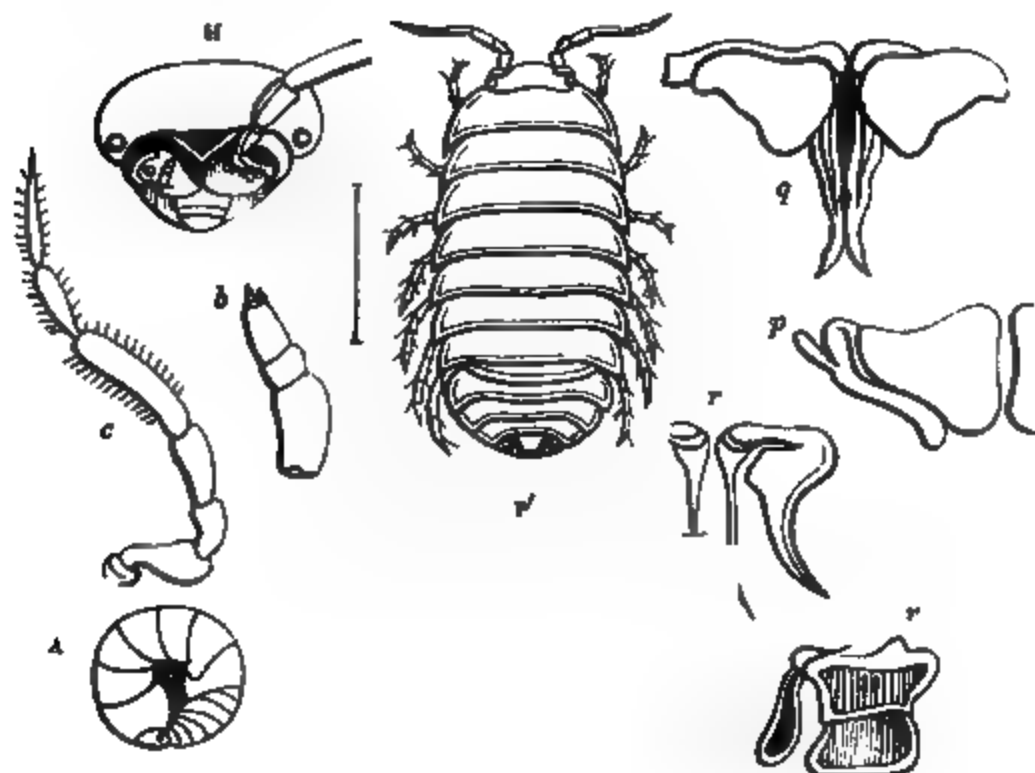
“The eyes are supported on the cephalic segment alone. The margin of this is raised, forming an angular projection in the middle of the forehead, passing back from whence, as it forms the orbital margin, to the entire exclusion of the third segment, the lateral lobes being here remarkably small, and derived entirely from the cephalic segment.”—Kinahan.

The animals, when alarmed, have the habit of rolling their bodies into a perfect globular mass, the antennæ being completely concealed, for which purpose the front margin of the head is provided with a groove on each side, within which the basal joints of the outer pair of these organs are lodged (fig. A).

* The Mammalians thus popularly named being generically known under the name of *Dasypus*, we have retained Latreille's name of *Armadillo*, which has been generally adopted for these Crustaceans.

ISOPODA.
NORMALIA.

ONISCIDÆ.



ARMADILLO VULGARIS.

Specific character. Elliptical, very convex, upper surface delicately punctured; of a dark leaden or steel-grey colour, with paler spots, and with the hind margins of the segments generally pale. Second joint of outer antennæ with the tip dilated at its outside. Uropoda with the outer division broad, short, exactly filling the space between the sides of the terminal and penultimate segments of the pleon.

Length, about half to two-thirds of an inch.

Oniscus armadillo.
Armadillo vulgaris.

LINNAEUS, Syst. Nat. ii. p. 1062.
LATREILLE, Hist. Nat. Crust. et Ins. vii.
p. 48. Genera Crust. et Ins. i. p. 70.
LEACH, Edinb. Encycl. vii. p. 406.
Trans. Linn. Soc. xi. p. 376. Suppl.
Enc. Brit. i. p. 429. SAMOUELLE, Rat.
Compend. p. 112. DESMAREST, Cons.
Crust. p. 325. WHITE, Cat. Brit. Crust.
p. 78. Pop. Hist. Brit. Crust. p. 238.

| | |
|-------------------------------------|--|
| <i>Armadillidium vulgare.</i> | MILNE EDWARDS, Crust. iii. p. 184. BURGERSDIJK, Annot. p. 51. ZADDACH, Syn. Crust. Pruss. p. 19. JOHNSON, Syn. Framst. Sver. Onisc. p. 34. |
| <i>Armadillium vulgare.</i> | KINAHAN, Nat. Hist. Rev. vol. iv. 1857, p. 276, pl. xxi. figs. 3, 9—13. |
| <i>Oniscus cinereus.</i> | ZENKER, in Panzer, Heft. 62. n. 22. |
| (Var.) <i>Armadillo variegatus.</i> | LATREILLE, Gen. Cr. et Ins. i. p. 72, n. 2. KOCH, Cont. Panzer, Heft. 178 n. 15, and 186, n. 2. |
| <i>Armadillidium Zenkeri.</i> | BRANDT, Consp. Mon. Crust. Onisc. Bull. Mosc. vi. 185. |
| (Var.) <i>Armadillo opacus.</i> | KOCH, Cont. Panz. Heft 180, n. 3. |
| (Var.) <i>Armadillo Willii.</i> | KOCH, Cont. Panz. Heft. 186, n. 1. |
| <i>Armadillo pulchellus.</i> | SCHNITZLER, Onisc. Bonn. p. 26 (?). |

THIS very widely dispersed species is subject to great variation in the amount of its pale markings, which has led to the establishment of a great number of supposed species, as appears from the citations quoted above. We have not been able to recognize more than a single species amongst them, which is well distinguished by the perfectly globular form in which it is able to roll itself up when alarmed, as represented in the lower left-hand figure of the accompanying wood-cut. The extremity of the tail and of the flattened truncated appendages of the last caudal segment exactly coincides with the front margin of the head, completely concealing the deflexed antennæ and legs.

The head is produced on each side immediately below the eye into a short transverse ridge, forming the upper edge of a groove, within which the basal joints of the antennæ are lodged; the lower edge of the groove being also produced into a moderately prominent rounded lobe. The labrum or upper lip is triangular, and transversely prominent along its straight upper edge. The inner antennæ are very minute and apparently three-jointed, the middle joint being the smallest, but

under a strong magnifying power the rudiments of two very minute terminal joints are to be perceived, as well as several short thickish spines. The large outer antennæ are seven-jointed, the second joint roundly dilated at its outer edge at the tip, the fifth joint long, the seventh the slenderest, with a minute distinct seta at the tip.

The third segment of the tail is laterally continuous with the edge of the seventh segment of the body, the two basal segments of the former, although quite distinct, being short and greatly abbreviated at the sides. The hind margin of the fifth segment is semicircular, the emargination being filled in by the small triangular sixth segment, of which the apex is obtuse, and by the flattened and truncated outer division of the first pair of false legs, the inner division being small, flattened, and ovate. The five anterior pairs of appendages of the tail differ considerably in form, the first pair being composed of two flattened, somewhat triangular, plates; the second pair in the male is nearly similar in form, but is provided with a large pair of elongated horny lobes, slightly curved at the tips; the third pair in the male is more sabre-shaped, with a slender horny appendage, having the tip bent and acute; the fourth, fifth, and sixth pairs have the plates triangular-shaped.

The general colour is leaden, or dark steel-grey, with spots and patches of dull buff or whitish: it varies, however, to brownish testaceous. It inhabits rather dry places under stones, decaying timber, and among herbage, and is often seen running about foot-paths, rolling itself up into a ball at the least alarm. This has gained for it the name of *Pill millepede*, and in "former times it was highly reputed for its supposed medicinal virtues, the old books of *Materia Medica* informing us that when dried and pulverized they have a faint disagreeable

smell, and a somewhat pungent, sweetish, nauseous taste, and are highly celebrated in suppressions, in all kinds of obstructions of the bowels, in the jaundice, ague, weakness of sight, and a variety of other disorders." And the wine of *Millepedes*, prepared by crushing these animals when fresh, and infusing them in Rhenish wine, is spoken of as an "admirable clearer of all the viscera, yielding to nothing in the jaundice and obstructions of the kidneys. In the light of modern science, we can impute the cures attributed to these creatures only to the effect produced upon the imagination of the patient, and the curative powers of nature, for, beyond some slight demulcient qualities, they must be wholly inert, and are now wisely discarded from the Pharmacopæias." (Fitch, in Report on Noxious, Beneficial, and other Insects of the State of New York. Albany, 1855.) They are still taken medicinally in some parts of Somersetshire.

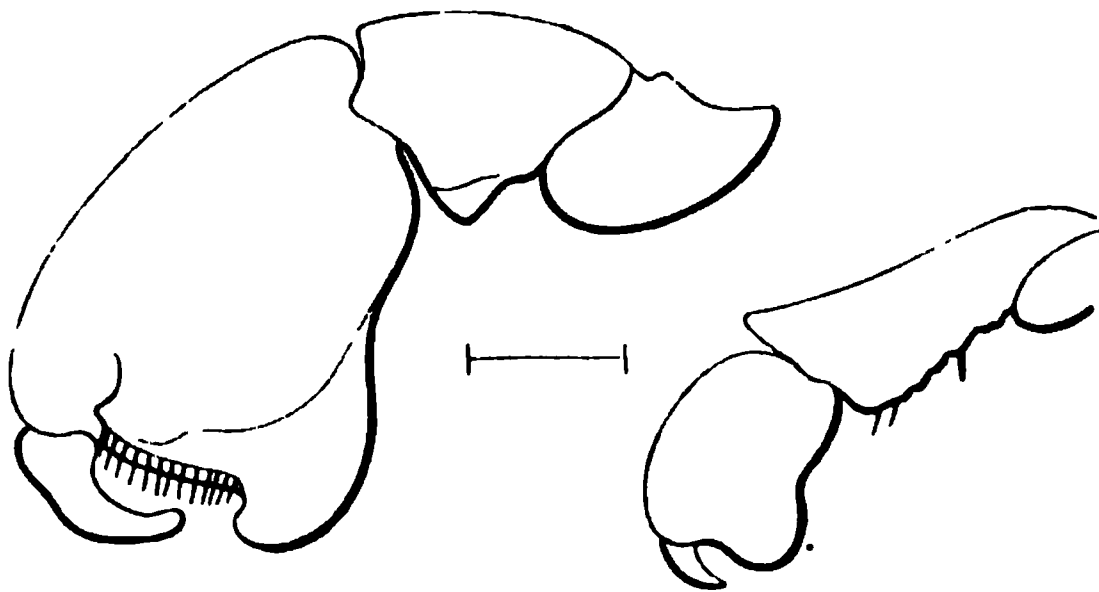
The species is very widely dispersed and very common. Its recorded localities are near London, and in Kent, and generally throughout Ireland. It is very abundant in the Midland counties, as well as in Devonshire and Cornwall.

A P P E N D I X.

DESCRIPTIONS OF NEW SPECIES.

AMPHIPODA.
SALTATORIA.

ORCHESTIIDÆ.
(Vol. I. p. 87.*)



ORCHESTIA BREVIDIGITATA, N.S.

Specific character. Second pair of gnathopoda with the propodos broader at the distal extremity; the palm being at right angles with the upper margin, nearly straight, fringed with a series of equidistant setæ, and bounded below by an obtusely rounded lobe.

Length, about eight-twentieths of an inch.

THIS species differs from any that we have hitherto examined. It bears a closer resemblance to *O. euchore*, which Dr. Fritz Müller has described, from the shores of Brazil, than any other with which we are acquainted.

The most striking feature is that of the form of the second pair of gnathopoda, as described above.

The dactylos of the second pair of gnathopoda is nearly one-third shorter than the palm, and one-half the width of

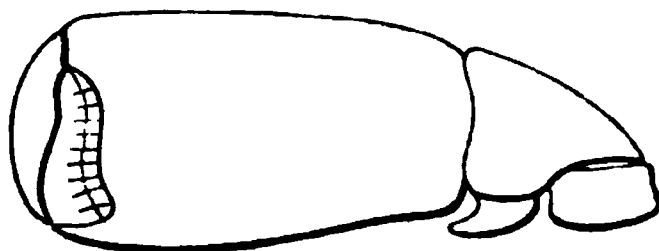
the distal margin of the propodos. In *O. euchore* the hand is more ovate, and the dactylos reaches to the extremity of the palm.

The hand of the second pair of gnathopoda is smaller in proportion than that of the male in other species, which, together with the size of the animal, incline us to believe the specimen to be a not yet fully grown animal.

We are indebted for this species to Mr. Edward, who took it near Banff. Its eyes are black, and its colour a light olive-green. It probably has been passed over for the young of the more common species.

AMPHIPODA.
NATATORIA.

STEGOCEPHALIDES.
(Vol. I. p. 66*.)



MONTAGUA CLYPEATA.

Specific character. Second pair of gnathopoda with the propodos oblong, slightly widening to the distal extremity, where it is truncated, terminating below in a porrected point ; the palm slightly curved and serrated.

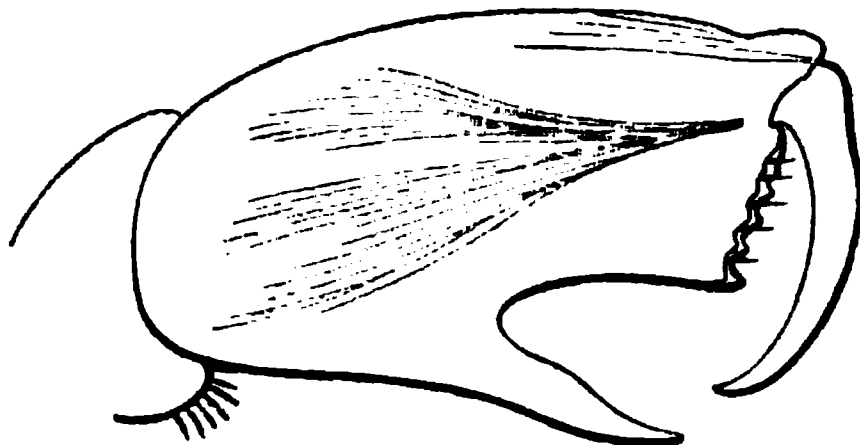
Length, three-twentieths of an inch.

Montagua clypeata. SPENCE BATE, Cat. Amph. B. M. p. 58, pl. ix. fig. 4
Leucothoë clypeata. KROY., Nat. Tids. iv. p. 141, pl. 6, fig. 2a. LILLJEBORG,
in Ofvers. af Kongl. Vetensk. Forhandl., 1851.

SOME specimens, taken by the Rev. A. M. Norman off the coast of Northumberland, agree so closely with the description and figures of Kroyer above referred to, that we have little doubt but that they belong to the species which he has described under the above name. The form of the hand of the second pair of gnathopoda, of which we give a figure, bears such a relation to that which we have described as belonging to *M. pollexiana*, that we are inclined to believe that Kroyer's specimen may be but the female of ours. But this is yet to be determined, in which case our species would yield its name to the earlier one of Kroyer.

*AMPHIPODA.**NATATORIA.**STEGOCEPHALIDES.*

(Vol. I. p. 66.**)

*MONTAGUA NORVEGICA.*

Specific character. Second pair of gnathopoda having the propodos large and oblong, armed in the middle of its under edge with a strong projecting tooth, reaching as far as the under angle of the serrated palm.

Length, about a quarter of an inch.

Montagua norvegica. SP. BATE, Cat. Amph. B. M. p. 370.

Leucothoë norvegica. LILLJEBORG, Ofvers. af Kongl. Vet. Akad. 1850, p. 335.

BRUZELIUS, Skand. Amph. Gam. p. 97.

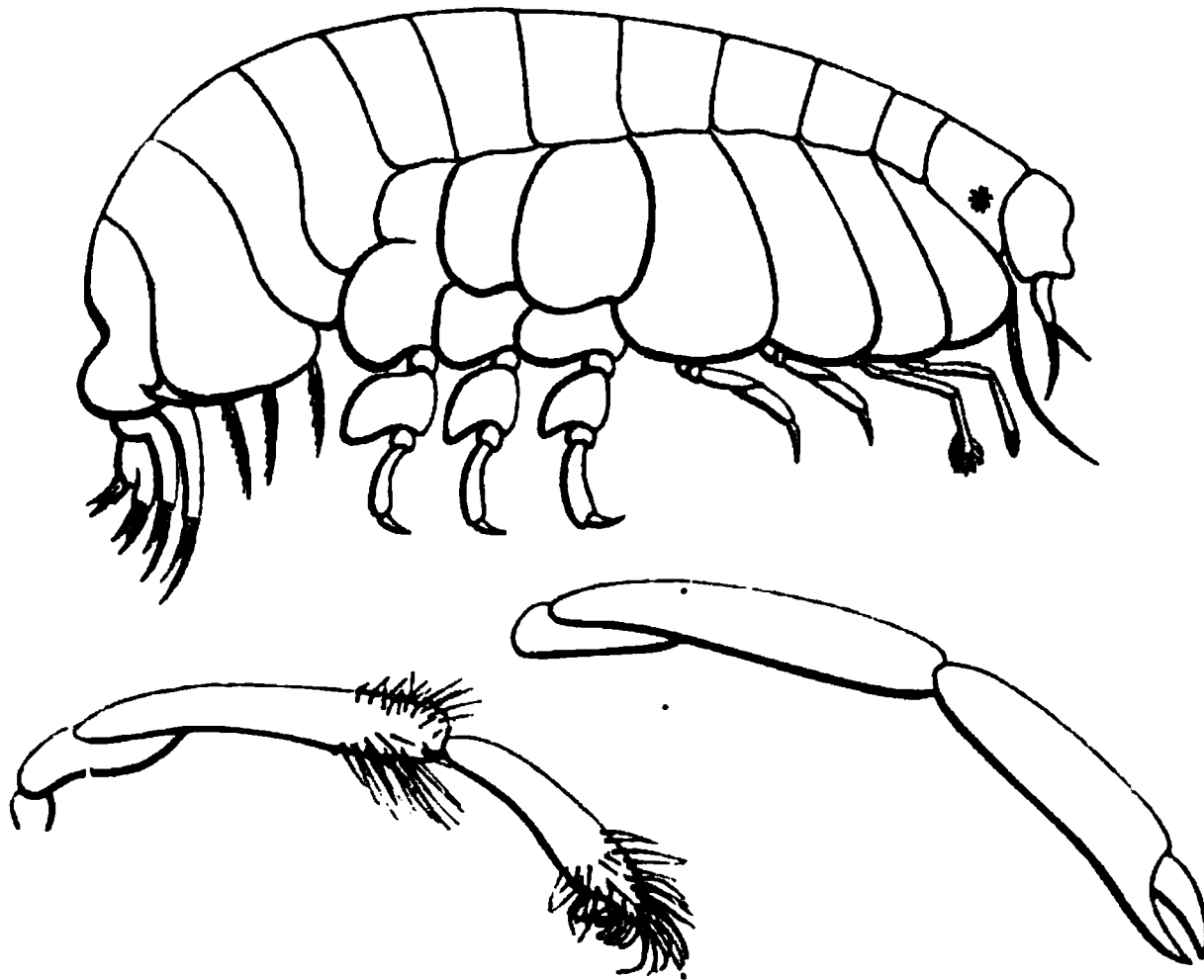
THIS species appears to agree with Lilljeborg's description of *Leucothoë norvegica*, chiefly in the formation of the propodos of the second pair of gnathopoda.

The hand is large, and armed with a strong sharp tooth that projects from near the middle of the lower or posterior margin, the apex of which reaches to a line with the palm, from which it is separated by a deep excavation, the anterior margin of which is directed in a line parallel with the anterior margin of the propodos. The palm is straight, furnished with five small broadly based denticles. The dactylus reaches beyond the palm, but does not extend to the extremity of the thumb-like tooth of the hand.

This species was taken near Banff by Mr. Edward.

AMPHIPODA.
NATATORIA.

LYSIANASSIDES.
(Vol. I. p. 118.*)



Genus—OPIS. (*Kroyer.*)

Generic character. Resembles *Anonyx*, with the exception that the first pair of gnathopoda have the inferior angle of the propodos considerably produced, so that the hand is formed into a didactyle chela.

OPIS LEPTOCHELA, N.S.

Specific character. Upper antennæ with the two basal joints large ; lower antennæ half as long again as the upper. Both pairs of gnathopoda minute, slender, and subequal.

Length, about one-fourth of an inch.

THE cephalon is small, not produced anteriorly. The segments of the pereion and pleon are dorsally subequal in length ; the fourth segment of the pleon having a deep notch on the dorsal surface. The eyes are small and round. The first two joints of the superior antennæ large ; the flagellum short ; secondary appendage short. The inferior antennæ are slender, being half as long again as the superior. Coxæ deep. Gnatho-

poda slender, cylindrical, subequal; first pair having the propodos nearly as long as the carpus; inferior angle longitudinally produced to a fine point, slightly curved; dactylos as long as and parallel with the digital process of the propodos: second pair rather more slender than the first, with the propodos nearly as long as the carpus, and furnished with a copious brush of hairs; dactylos minute, simple, almost lost in the cilia of the preceding joint. Periopoda short and robust.

Specimens of this species have been taken by the British Association Dredging Committee in the Shetlands, and by Mr. G. Brady, on a specimen of *Echinus esculentus*, off the Isle of Man.

AMPHIPODA.
NATATORIA.

LYSIANASSIDES.
(Vol. I. p. 118.²²)

OPIS QUADRIMANA, N.S.

Specific character. Upper antennæ with the secondary appendage nearly reaching to the extremity of the flagellum. First pair of gnathopoda with the propodos quadrate, truncated at the end, the inferior angle armed with a strong pointed spine.

Length, one-eighth of an inch.

THIS species differs from the preceding in having the superior antennæ longer, and furnished with a secondary appendage that reaches nearly to the extremity of the flagellum; the inferior antennæ being scarcely longer than the superior, and in the first pair of gnathopoda being much more robust than the second. The propodos of the first pair is quadrate, the palm being at right angles with the anterior and posterior margins, and armed with a minutely denticulated thickened margin; inferior angle produced to a short strong tooth, against which the apex of the slightly curved dactylos impinges.

This species was sent to us by Mr. Edward, who took it off the Banffshire coast.

AMPHIPODA.
NATATORIA.

AMPELISCIDES.
(Vol. I. p. 137.*)



AMPELISCA LÆVIGATA.

Specific character. Posterior margin of third segment of pleon regular. Superior antennæ attached to the lower angle of the anterior margin of the cephalon.

Length, about one-fifth of an inch.

Ampelisca lævigata. LILLJEBORG, Ofvers. af Kongl. Vet. Akad. Forhandl.
SPENCE BATE, Cat. Amph. B. M. p. 96.

WE have received from the Rev. A. M. Norman a specimen that probably belongs to this species. It differs little from *A. belliana*, except in the absence of the ornate character of the posterior margin of the third segment of the pleon, and in having the superior antennæ attached to the lower angle of the anterior margin of the cephalon.

It was taken off the coast of Durham. Lilljeborg obtained his specimen at Kullaberg, on the coast of Norway.

AMPHIPODA.
NATATORIA.

AMPELISCIDES.
(Vol. I. p. 187.²²)



Genus—HAPLOOPS. (*Lilljeborg.*)

Generic character. Closely allied to *Ampelisca*, but differs in having the cephalon less anteriorly produced, and the organs of vision reduced to two.

HAPLOOPS TUBICOLA.

Specific character. Superior antennæ about one-third of the length of the animal, ciliated beneath, without an accessory filament. Two pairs of gnathopoda small and hairy. First and second pereiopoda terminated by long stylate fingers.

Length, about half an inch.

Haploops tubicola. LILLJEBORG, Öfvers. af Kongl. Vet. Akad. 1855.
BRUNELIUS, Skand. Amph. Gam. p. 88. SERNOW
BATE, Cat. Amph. B. M. p. 371.
Ampelisca Eschrichtii? LILLJEBORG, l. c. 1852, p. 6.

CEPHALON anteriorly depressed, without a rostrum, having the superior antennæ affixed to the apex, about one-third the length of the animal, and inferiorly ciliated; inferior antennæ slightly longer than the superior: gnathopoda subequal, hairy: first two pairs of pereiopoda with long stylate dactyla,

third and fourth pair having the basis round, and the dactylos short, curved, and posteriorly directed; fifth pair having the basis long and narrow, and the propodos and dactylos almost rudimentary: posterior pair of pleopoda long, with two sub-equal rami, ciliated, on the inferior margin; telson two-lobed.

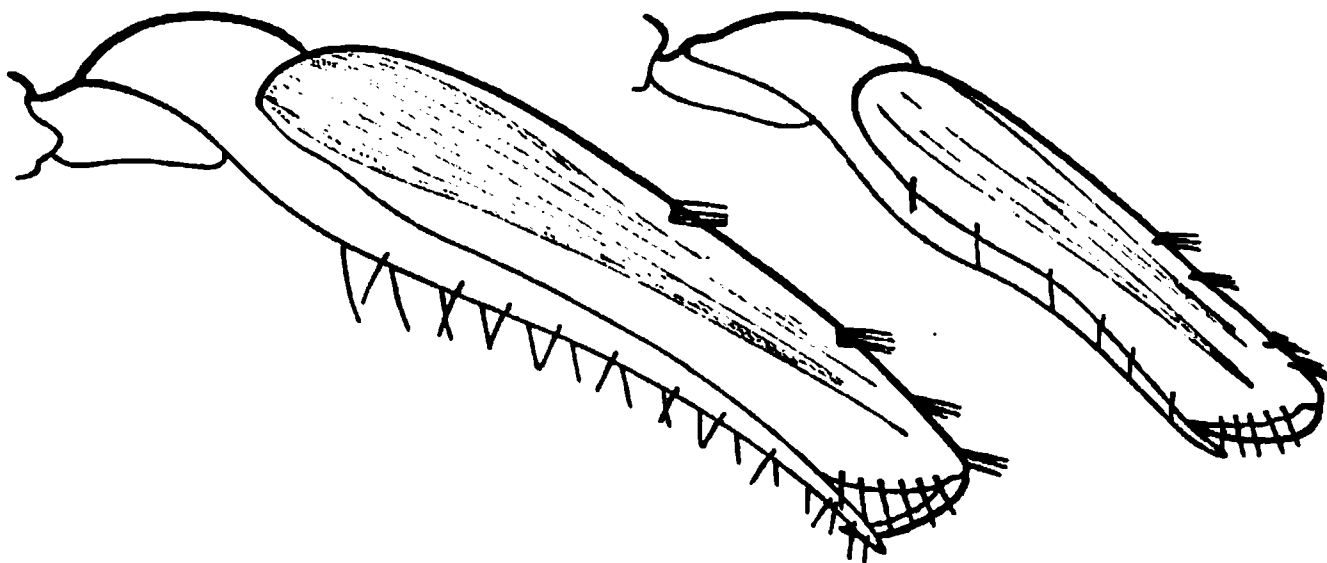
This species was first taken off the coast of Norway, in 1854. It has since been taken in England, off Tynemouth, off the Holy Island, and in the Shetlands, by the Rev. A. M. Norman.

AMPHIPODA.

NATATORIA.

PHOXIDES.

(Vol. I. p. 170.*)



MONOCULODES LONGIMANUS, N.S.

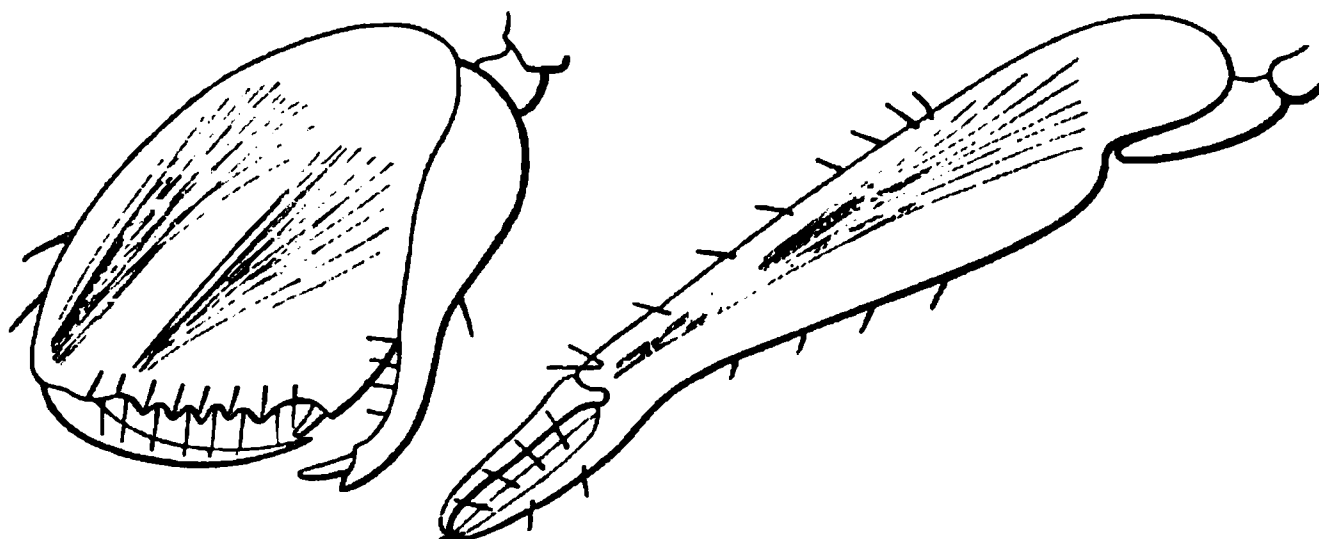
Specific character. Dorsal surface slightly carinated. First pair of gnathopoda long and narrow, resembling the second pair.

Length, about one-fifth of an inch.

THIS species differs from those previously described in having the first pair of gnathopoda long and narrow, and in fact developed more nearly on the type of the second pair. The dorsal surface is slightly carinated. It was sent to us from Banff by Mr. Edward. We have two specimens, both of which have the superior antennæ wanting, while in one the inferior antennæ are short, and in the other they are long and slender. We consider the latter to be the male form, and the former the female.

AMPHIPODA.
NATATORIA.

PHOXIDES.
(Vol. I. p. 178. *)



KROYERA BREVICARPA, N.S.

Specific character. Superior antennæ short; inferior as long as the entire animal. Second pair of gnathopoda chelate, with the lower angle of the carpus not extending along the inferior margin of the propodos.

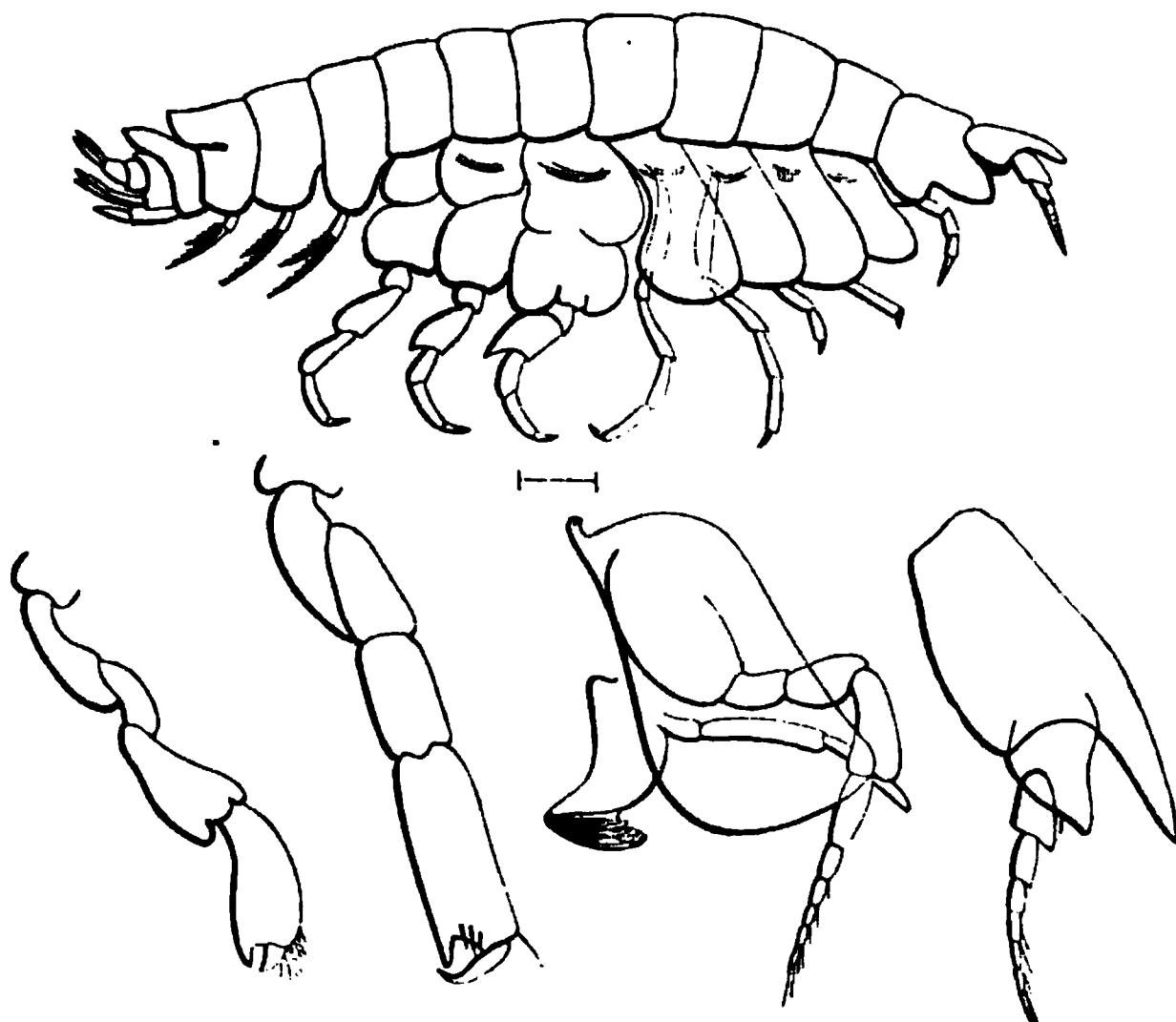
Length, about one-sixth of an inch.

THIS species differs from those previously described in having the superior antennæ short and thickly furnished with auditory cilia; the inferior antennæ being as long as the animal; the first pair of gnathopoda, with the propodos, ovate, having the palm armed with three or four obtuse denticles and two rows of hairs, and defined by a strong spine; the anteriorly produced carpus also terminating in a strong spine; and in having the second pair of gnathopoda chelate, with the antero-inferiorly produced angle not extended along the inferior margin of the propodos.

It was taken at Banff by Mr. Edward.

AMPHIPODA.
NATATORIA.

LYSIANASSIDES.
(Vol. I. p. 118.***)



Genus—LEPIDEPECREUM.

Generic character. Cephalon having the orbital or intra-antennal process considerably developed and produced. Pereion well developed. Pleon having the last four segments very short. Eyes not made out; supposed to occupy the intra-antennal process;—superior antennæ having the upper surface of the first two joints of the peduncle considerably produced anteriorly, having no secondary appendage. Inferior antennæ posterior to the superior. Mandibles furnished with a biarticulate appendage. First pair of gnathopoda moderately robust, subchelate. Second pair feeble and chelate or subchelate. Posterior pair of pleopoda short, biramous. Telson —?

LEPIDEPECREUM CARINATUM, N.S.

Specific character. Body dorsally carinated. Segments subequal. Fourth and fifth segments of pleon produced into a tooth. Gnathopoda minute and slender.

Length, one-fifth of an inch.

THE cephalon has the intra-antennal process produced anteriorly as far as the infero-distal extremity of the first joint

of the peduncle of the superior antennæ, when the latter is deflected in the same line. The segments of the pereion and the anterior three of the pleon are subequal; the three posterior segments of the pleon very short; and the fourth and fifth dorsally produced into a tooth.

The superior antennæ have the first joint of the peduncle thick, and as long as the cephalon, with the upper surface anteriorly produced into a scale-like process, quite as far as, if not beyond, the distal extremity of the third joint of the peduncle; second joint with the upper surface anteriorly produced like the first; third not so produced; flagellum short, consisting of four or five articuli. The inferior antennæ are short, having the peduncle longer than the flagellum; flagellum consisting of four articuli; and the whole organ not reaching beyond the extremity of the first joint of the peduncle of the upper antennæ. The first pair of gnathopoda have the propodos but little longer and not broader than the carpus; anterior and posterior margins subparallel; palm slightly oblique, and defined by an acute tooth; dactylos short and curved. The second pair of gnathopoda have the propodos shorter than the carpus, anterior and posterior margins curved, sub-parallel; digital process short and conical; dactylos not longer than the digital process of the propodos, conical, curved. The pereiopoda are short, robust, subequal last pair slightly the longest; third pair having the coxa quadrate, half as deep as that of the preceding; basos circular, as deep as the coxa; meros posteriorly produced to a thin angular plate. The fourth and fifth pairs differ from the third in being less robust and slightly longer. The rami of the three posterior pairs of pleopoda short. The telson has not been made out.

Taken at Banff by Mr. Edward, associated with *Anonyx longicornis*, with which it is very closely allied, being perhaps a young female.

ANONYX LONGICORNIS (vol. i. p. 91).—The absence of a secondary appendage to the upper antennæ must separate it from the genus *Anonyx*, to which it is assigned in the body of the work. We therefore arrange it in the present genus in consequence of its near affinity with the last species.

AMPHIPODA.
NATATORIA.

GAMMARIDES.
(Vol. I. p. 259.)

Genus—NICIPPE. (Brazelius.)

Nicippe. BRAZELIUS, Skand. Amph. Gam. p. 99. SPENCE BATE, Cat. Amph. B. M. p. 373.

Generic character. Animal generally robust. Segments of the pereion subequal, the three anterior of the pleon slightly longer, increasing posteriorly. Cephalon nearly as long as the first two segments of the pereion. Superior antennæ longer than the inferior, and furnished with a small secondary appendage. Coxa moderate, subequally deep. Gnathopoda subequal, subchelate. Two posterior pairs of pereopoda considerably longer than the preceding. Posterior pair of pleopoda biramose. Telson simple; deeply cleft.

NICIPPE TUMIDA.

Specific character. Superior antennæ nearly half the length of the body, with a small three-jointed secondary appendage. Upper antennæ rather shorter. Gnathopoda subequal, with the propodes elongate-ovate. Three posterior pairs of pereopoda gradually elongated.

Length, half an inch.

Nicippe tumida. BRAZELIUS, Skand. Amph. Gam. p. 99, fig. 19. SPENCE BATE, Cat. Amph. B. M. p. 374.

FOURTH segment of the pleon having the posterior margin furnished with two small lateral teeth on the dorsal surface.

Eyes not recognizable in specimens that have reached us. Superior antennæ longer than the inferior, having a small tri-articulate secondary appendage; inferior antennæ having the peduncle longer than the peduncle of the superior. Gnathopoda subequal and similar, having the inferior margin and palm furnished with long cilia. Dactylos long and slender. First two pairs of pereopoda subequal and of moderate length; third pair not longer than the preceding; fourth pair about one-third as long again; fifth pair longer than the fourth; posterior pair of the pleopoda subfoliaceous and ciliated. Telson single, but cleft deeply, so as to appear double.

We have received one or two specimens from Mr. Jeffreys, who dredged them off the Shetlands.

AMPHIPODA.
NATATORIA

GAMMARIDES.
 (Vol. I. p. 647 *)



Genus—CHEIROCRATUS. (Norman.)

Trans. Nat. Hist. Soc. Northumberland and Durham, vol. i. p. 12.

Generic character. Long and slender. Segments of the pereion and pleon subequal. Eyes round. Antennæ subequal; peduncle of the superior shorter than the peduncle of the inferior; furnished with a secondary appendage. Mandibles having a long appendage. Gnathopoda unequal: first pair simple; second pair long, large, and robust. Posterior pair of pereopoda longer than the preceding. Posterior pair of pleopoda long and unbranched. Telson double.

CHEIROCRATUS MANTIS.

Specific character. Dorsal surface of the fourth segment of the pleon produced posteriorly into a short central and a long lateral tooth on each side, the space between being occupied by a long cilium. Fifth segment resembling the fourth, but having the teeth less important and the cilium absent.

Length, nearly half an inch.

Cheirocratus mantis. NORMAN, op. cit. vol. i. p. 13, pl. vii. figs. 14, 15.

THE superior antennæ about the length of the cephalon
 VOL. II. L L

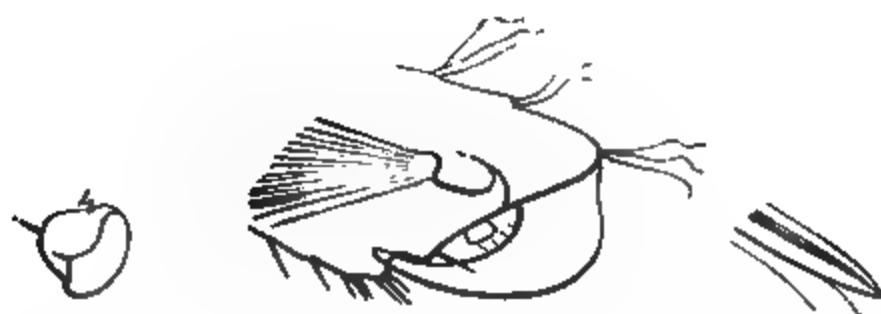
and the four anterior segments of the pereion. Flagellum about the same length as the peduncle. Secondary appendage small. The inferior antennæ are a little longer than the superior, the peduncle being about three-fourths of the antennæ. The first pair of gnathopoda are cylindrical, having the posterior margin of the carpus and propodos thickly ciliated; carpus as long as the propodos, tapering; dactylos apical, straight. The second pair of gnathopoda are long; propodos ovate; palm oblique, defined by a strong tooth, armed near the base of the dactylos with a double dentated tubercle, and near the middle with three teeth, of which the anterior is the largest; dactylos short, shorter than the palm, curved and simple. The three posterior pairs of pereiopoda have the basos narrow and the entire appendage increasing posteriorly in length; the posterior pair of pleopoda having the ramus nearly three times as long as the peduncle. The telson is tipped with strong cilia.

This species was first taken and described by the Rev. A. M. Norman, from a single specimen dredged in deep water off Holy Island. We have since received it, through Mr. Dawson, from the coast of Aberdeenshire.

AMPHIPODA.
NATATORIA.

GAMMARIDES.
(Vol. I. p. 410.)

2



MEGAMCERA MULTIDENTATA. (Norman MSS.)

Specific character. Body long and slender. Second segment of pleon with three teeth on the middle of the posterior margin; third segment with four; fourth, fifth, and sixth segments with two similar teeth.

Length, six-tenths of an inch.

THE body is long and slender, with the segments subequal; the second segment of the pleon having a central, and on each side a lateral tooth on the posterior dorsal margin; third having a central and two lateral teeth on the dorsal margin; the three following segments without a central, but possessing on each a lateral tooth, at the base of which a strong hair or spine exists.

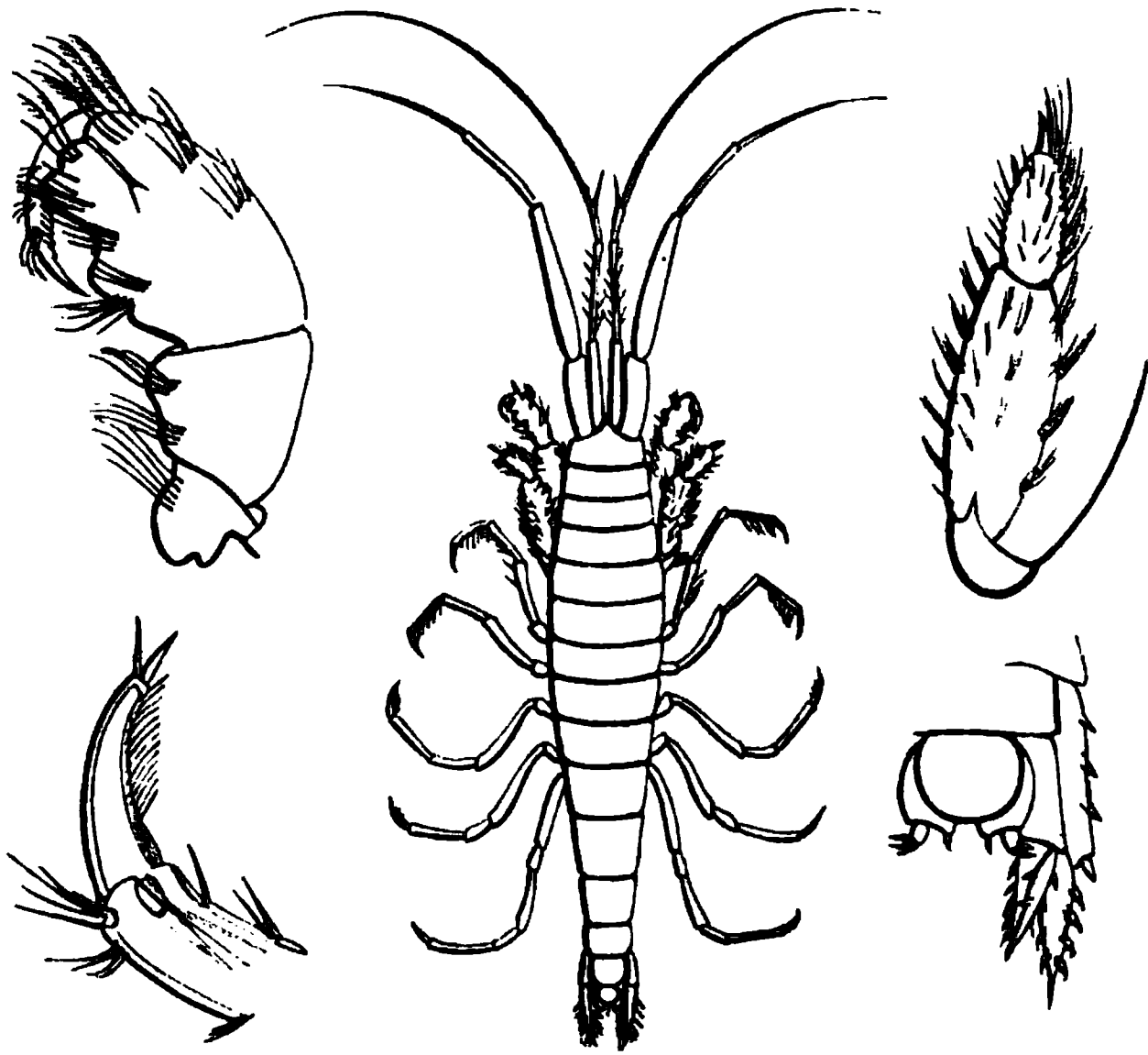
The eyes are round and black. The superior antennæ are half the length of the animal, and the peduncle is half the length of the antennæ. The first joint is as long as the cephalon; the second joint is a little longer and slighter than the first; the third is short. The articuli of the flagellum are as long again as broad; the secondary appendage consists of five articuli. The inferior antennæ are about half the length of the superior; the peduncle extends to the extremity of the second joint of the peduncle of the superior. Olfactory denticle

long and prominent. Third joint of the peduncle short and stout, and furnished at the infero-anterior angle with a strong tooth and a few hairs. Fourth and fifth joints long, slender, and subequal. The flagellum consists of eight articuli. First pair of gnathopoda slender; propodos shorter and not broader than the carpus, furnished with numerous and long hairs; dactylos short and impinging closely on the palm. Second pair long and well developed; carpus distally dilated: propodos subconfluent with the carpus, long, broad; inferior and superior margins subparallel; palm oblique, armed near the centre with a broad flat-headed tubercle, furnished with a few hairs, slightly posterior to which is a double-cusped process, or strong tooth, between the two points of which the apex of the dactylos impinges; and at the infero-anterior angle are two prominences, carrying one or two strong straight spines: the dactylos is very robust, abruptly curved, sharp at the point, and shorter than the palm. Posterior pair of pleopoda (wanting). Telson double-lobed; each lobe surmounted by a single spine.

Hab.—Guernsey, where it was taken by the Rev. A. M. Norman.

AMPHIPODA.
DOMICOLA.

PODOCERIDES.
(Vol. I. p. 491. *)



Genus—UNCIOLA.

- Unciola.* SAY, Journal Acad. Nat. Sci. Philad. i. p. 389. EDWARDS,
Ann. des Sc. Nat. t. xx. p. 383. Hist. des Crust. iii.
p. 69.
- Glaucanome.* KROYER, Nat. Tidsk. i. p. 501. SPENCE BATE, Cat. Amph.
B. M. p. 278.

Generic character. Long and slender, not much compressed. Segments subequally long, increasing in length a little posteriorly to the third segment of the pleon. Eyes small and round. Superior antennæ furnished with a slender flagellum and a small secondary appendage. Inferior antennæ subequal with the superior. Gnathopoda robust: first pair subchelate; second pair not subchelate. Pereiopoda long and slender; coxæ small, subequal; basos of the three posterior pairs but slightly, if at all, enlarged. Posterior pair of pleopoda having but a single branch, and that almost rudimentary. Telson single, flat.

UNCIOLA LEUCOPES.

Specific character. Upper antennæ nearly half the length of the animal. Secondary appendage minute. Gnathopoda fasciculated. Terminal pleopoda armed with short strong spines.

Length, one-third of an inch.

Unciola leucopes. KROYER, Nat. Tidsk. i. 491, pl. 7, fig. 2. SPENCE BATE, Cat. Amph. B. M. p. 279.

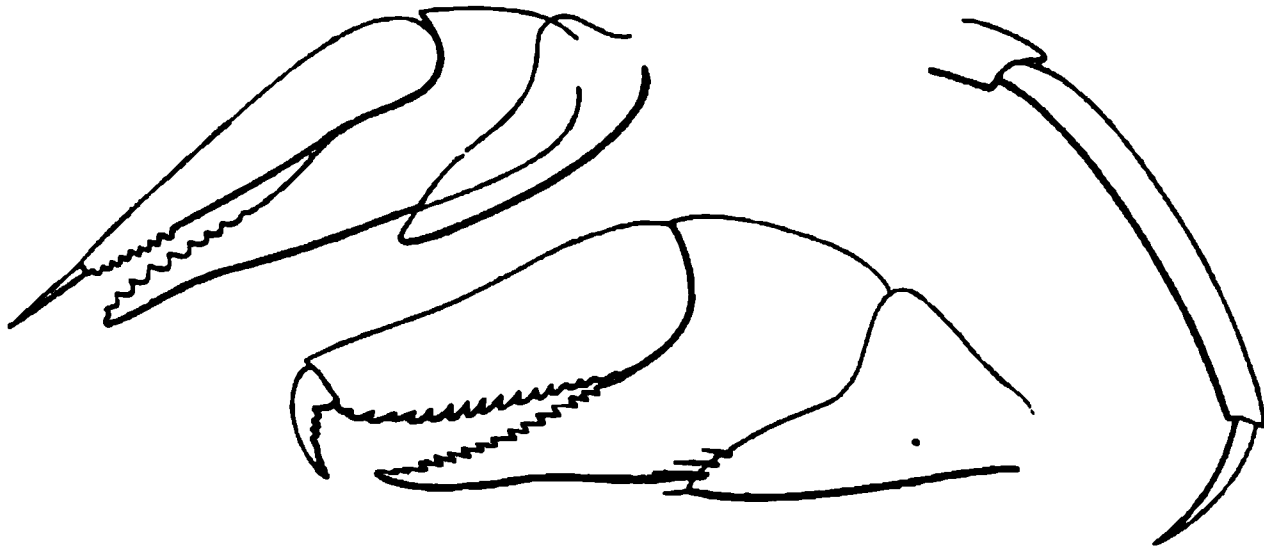
„ *planipes.* NORMAN, Trans. Nat. Hist. Soc. of Northumberland and Durham, vol. i. pl. vii. figs. 9—13.

THE eyes are small. The antennæ are subequal, the superior pair nearly half the length of the animal: first joint of the peduncle rather longer than the cephalon; second rather longer than the first; the secondary appendage being small. The inferior antennæ are shorter than the superior, having the peduncle rather longer than the peduncle of the superior. The gnathopoda are armed with fasciculi of hairs; first pair having the propodos ovate, with the palm waved and imperfectly defined, furnished with several fasciculi of long cilia; dactylos serrated along the inner margin. Second pair having the carpus almost as long again as the propodos; propodos tapering; dactylos apical, minute. The pereiopoda are long, slender, and cylindrical. The pleopoda have the antepenultimate pair longer than the penultimate; the penultimate longer than the ultimate; ultimate scarcely reaching beyond the telson. Telson circular.

This species was taken by the Rev. Mr. Norman off Holy Island, on the coast of Northumberland and Durham, and named by him *U. planipes* in the Transactions of the Natural History Society of Northumberland and Durham. We had previously received it from the Haaf Ground, Shetland. We believe, however, that the species probably is identical with Kroyer's Greenland species, the distinction between the two arising from omissions in description and figure rather than any clear variation of character.

AMPHIPODA.
HYPERINA.

HYPERIIDÆ.
(Vol. II. p. 18.*)



HYPERIA TAURIFORMIS, N.S.

Specific character. Antennæ very short. Both pairs of gnathopoda with the proximate margins of the propodos and carpus strongly serrated, as well as the dactylos of the second pair.

Length, four-twentieths of an inch.

THE antennæ in this species are very short. The inferior angle of the carpus is anteriorly produced in both pairs of gnathopoda, and the proximal margins of the propodos and carpus are strongly serrated, as also is the dactylos of the second pair.

Dana established the genus *Tauria* for the reception of those species of *Hyperia* that have the antero-inferior angle of the carpus of both pairs of gnathopoda so far anteriorly produced as to extend to the extremity of the propodos, thus forming a tolerably perfect but compound chelate organ. But so gradual is the development of this process from one species to another, that we can see no clearly defined limit where one genus may commence and the other end.

We have chosen a specific name for our new species which indicates its affinity with Dana's proposed genus.

The animal above described was taken at Banff by Mr. Edward.

AMPHIPODA.
HYPERINA.

HYPERIDÆ.
(Vol. II p. 18.**)



HYPERIA PREHENSILIS, N.S.

Specific character. Superior antennæ about the length of the head. Both pairs of gnathopoda with the carpus and propodus simple. Three hind pairs of pereopoda subprehensile at the tips.

Length, three-twentieths of an inch.

This species differs from *H. tauriformis* next described in having longer antennæ, the proximal margins of the carpus and propodus of both pairs of gnathopoda not serrated, and in having the propodus of the last three pairs of pereopoda inferiorly produced and armed with short strong cilia. This gives a prehensile character to the last three pairs of pereopoda that we have not recognized in other species.

Taken at Banff, by Mr. Edward, with the preceding species.

*AMPHIPODA.**HYPERINA.**HYPERIIDÆ.*

(Vol. II. p. 18.***)

HYPERIA CYANEÆ.

Specific character. Superior antennæ very short; flagellum scarcely longer than the peduncle. Gnathopoda subequal and nearly alike; first pair short, with the propodos subovate; superior margin arcuate, inferior straight. Dactyla of three posterior pairs of pereopoda long, sharp, and furnished with a bunch of cilia in the middle.

Length, rather more than three-twentieths of an inch.

Talitrus cyaneæ. SABINE, Appendix to Parry's Voyage, pl. i. figs. 12—18.

Metoechus cyaneæ. EDWARDS, Hist. des Crust. iii. p. 78. WHITE, Cat. Brit. Crust. (Brit. Mus.) 1847.

Hyperia cyaneæ. SPENCE BATE, Cat. Amph. p. 294, pl. 48, fig. 10.

A specimen of *Hyperia* has been sent to us by Mr. Edward, of Banff, that we take to be a variety of this species: it differs in having the antennæ much less developed than those in the typical specimens. It looks like a young *H. Galba*, with rudimentary antennæ; but one of the specimens sent to us has the incubatory pouch of the adult female fully developed, so that we cannot mistake it for a young animal. Mr. Edward says that he has never taken this species in a Medusa, and that he has frequently found it on the shores of the Moray Frith in December, January, and February, that is, at a time when the Medusæ are not on the coast.

AMPHIPODA.
HYPERINA.

HYPERIIDÆ.
(Vol. II, p. 18.***)

Genus—THEMISTO. (Guerin.)

Themisto. GUÉRIN MÉNEVILLE, Mém. de la Soc. d'Hist. Nat. de Paris, iv. 1828. EDWARDS, Ann. des Sci. Nat. xx. p. 393. Hist. des Crust. iii. p. 84. SPENCE BATES, Cat. Amph. Brit. Mus. p. 311.

Generic character. Cephalon transversely ovate. Perion not distended. Pleon slender. Eyes occupying the entire cephalon, dorsally separated. Antennæ short; superior pair having the flagellum cylindrical and uniarticulate; inferior pair more slender, and having the flagellum multiarticulate. Mandibulæ having an appendage. First pair of gnathopoda short, with the inferior angle of the carpus not anteriorly produced; second pair having the inferior angle of the carpus anteriorly produced. First two pairs of the pereopoda having the carpus dilated, the propodos cylindrical, and the dactylos inflected back against the carpus. Third pair of pereopoda extremely long, being twice the length of the preceding pair, and armed anteriorly with a series of comb-like setæ. The last two pairs of pereopoda not half the length of the preceding. Three posterior pairs of pleopoda being long. Telson single.

THEMISTO CRASSICORNIS.

Specific character. Superior antennæ very short, thick, biarticulate, furnished along their under surface with numerous auditory cilia; inferior antennæ with a flagellum composed of one short and one long joint. First two pairs of pereopoda having the carpi subovate, smooth, and unarmed along the inferior margin.

Length, half an inch.

Themisto crassicornis. KROYER, Grönl. Amph. p. 67, pl. iv. fig. 17.
EDWARDS, Hist. des Crust. t. iii. p. 85. SPENCE
BATE, Cat. Amph. B. M. p. 818, pl. i. fig. 12.

THE first two segments of the pereion are shorter than the rest, which are subequal. The superior pair of antennæ have the peduncle short, the flagellum uniarticulate, curved downwards at the extremity, and furnished along the inferior margin, for about two-thirds of its length, with auditory cilia. The inferior pair consist of a peduncle, of which two segments are visible, and a long slender multiarticulated flagellum. The first pair of gnathopoda are very short, not having the carpus anteriorly produced. The second pair of gnathopoda are not larger than the first, but having the inferior angle of the carpus anteriorly produced. The first two pairs of pereopoda resemble each other; the second pair is slightly the larger, having the meros and carpus broadly distended, the latter fringed along the inferior margin with a row of very fine short cilia, and a few long equidistant solitary hairs; propodos and dactylos reduced in character to a biarticulate joint, that bends back to form a prehensile organ with the carpus. The third pair of pereopoda are very long, quite as long again as the next succeeding pairs, having the propodos and carpus subequal in length, and the former furnished on the anterior margin with a comb-like row of fine teeth; dactylos short and slender. The two last pairs of pereopoda are about half the length of the third pair. The posterior pair of pleopoda is long and simple. The telson is short and dorsally flat, having a central process on the under surface that lies between the basal joints of the posterior pair of pleopoda. Colour, orange.

This species has been recently sent to us by Mr. Edward, who has taken several of different ages off the coast of Banff.

AMPHIPODA.
HYPERINA.

HYPERIIDÆ.
(Vol. II. p. 19.)



Genus—VIBILIA.

Vibilia. EDWARDS, Ann. des Sci. Nat. t. xx. p. 386. Hist. des Crust.
t. iii. p. 72. SPENCER BATH, Cat. Amph. B. M. p. 299.
Lanceola? SAY, Proc. Acad. Phil. p. 317.

Generic character. Cephalon small. Pereion smooth, not distended. First two segments of the pereion short, the rest gradually increasing in length. Segments of the pleon a little deeper than those of the pereion. Eyes small. Antennæ short; superior pair terminating in a vertically compressed uniarticulate flagellum. First pair of gnathopoda small, slender, cylindrical, having the inferior angle of the carpus but little, if at all, produced; second pair having the inferior angle of the meros and carpus considerably produced anteriorly. First two pairs of pereiopoda subequally long. Third and fourth pairs longer than the preceding, subequal. Last pair very short. Three posterior pairs of pleopoda, with the peduncle long and the rami short and compressed. Telson single.

VIBILIA BOREALIS, N.S.

Specific character. Cephalon not anteriorly produced. Pereion with the segments gradually enlarged. Flagellum of upper antennæ flat, with two rows of cilia on the internal surface. Last pair of pereiopoda minute.

Length, seven-twentieths of an inch.

THE pereion has the first segment short, each segment gradually increasing in length posteriorly to the third segment of the pleon. The eyes are vertically of an oblong oval form. The first pair of antennæ have the flagellum vertically and longitudinally flattened, the inner surface being furnished with two central rows of cilia, the cilia in one row being directed upwards, and in the other downwards. The second pair of antennæ are slender, cylindrical, not longer than the superior, articulations variable. The gnathopoda are subequal, small. The first two pairs of pereiopoda robust, subequal. The third and fourth pair subequal, longer than the preceding, but not more than one-third; propodos having the anterior margin fringed with fine rows of short teeth. The posterior pair of pereiopoda are scarcely half the length of the preceding. The pleopoda are subequal, reaching beyond the extremity of the telson, having the approximate margins only of the rami fringed with short strong spines. Colour reddish orange spotted with black.

Hitherto the species of this genus have been taken only as pelagic in tropical or subtropical latitudes. It is an interesting fact that this species should have been taken off the coast of Banff, from whence it was sent to us by that very successful observer, Mr. Edward, who in writing says: "I can say little as to its habits. I took eleven, and kept a few alive for a short time, but observed nothing in their manners beyond that which may be seen in the majority of species. I supplied them with plenty of sand, and also a few marine plants, but they neither seemed to be burrowers nor climbers, as they never went into the one nor appeared to care for the other. They, however, swam a little. This they do somewhat after the manner of *Callisoma crenata*; or, in other words, they rise gradually from the bottom until they reach the top; then putting on more power, they dash round and round the vessel. With close observation I observed that the superior antennæ were kept pretty well up and very widely apart, whereas the inferior were always directed downwards. All the legs were kept doubled up. I never saw them stretched out. They would then sink once more to the sand at the bottom. Here they would rest, sometimes a few minutes, sometimes longer,

when they would again repeat their voluntary evolutions. They did not, however, always rise to the surface. The journey was sometimes performed about midwater. They are, when alive, a most beautiful coloured species, variegated not unlike *Urothoë elegans*, and rivalling that animal in brightness of tints. I took one, however, that was all over a most brilliant red. I have been told that this species has never been found outside the Medusa. However this may be, all mine were. And what appears to be more extraordinary is, that, comparatively speaking, we have had no Medusæ here this season (1865). During the months of July, August, and September I have seen them, generally, by hundreds and thousands. All that I have this year observed have been three." Mr. Edward also informs us that he has seen specimens of these crustaceans thrown on the shore in extraordinary large quantities. After a storm one night, he saw them forming a band an inch and a half broad to an inch and a half deep, for thirty yards along the beach.

SUPPLEMENTAL NOTES.

ALLORCHESTES NILSSONII.

(Vol. I. p. 40.)

THE females of this species, and probably of all in the genus, have the second pair of gnathopoda, slightly larger than those of the first pair.

Genus—MONTAGUA.

(Vol. I. p. 53.)

Dr. Camil Heller (Beiträge zur näheren Kenntniss der Amphipoden des Adriatischen Meeres; Denkschr. Ak. Wiss. Wien, xxvi. p. 13) states that this genus is identical with *Probolium* of Costa.

PHOXUS HOLBOLLI.

(Vol. I. p. 143.)

Mr. Edward has sent us from Banff a specimen that corresponds with this species, except in having longer inferior antennæ.

We consider it the male form.

PHOXUS PLUMOSUS.

(Vol. I. p. 146.)

A specimen of this genus has been forwarded to us from Banff, by Mr. Edward, that corresponds with this species in general character, except in having very much longer lower antennæ, as well as a long plumose posterior pair of pleopoda.

We take it to be the male form.

ÆDICEROS PARVIMANUS.

(Vol. I. p. 161.)

Some specimens have been sent to us from the Shetlands by Mr. Gwynn Jeffreys, and from Banff, where they were taken by Mr. Edward, that so nearly correspond with this species, that we think they must be the male form. They differ from that described in having the upper antennæ but little longer than the peduncle of the lower; the lower antennæ as long as the entire animal; and the gnathopoda with hands somewhat larger, but scarcely equal to the "very large" hands as described by Kroyer in his description of the genus.

KROYERA ARENARIA.

(Vol. I. p. 173.)

A specimen of *Kroyera* has been sent to us by Mr. Robertson, who found it in sand near low water in Kames Bay, Milport. It differs from *K. arenaria* in having the inferior antennæ longer than the animal.

It may, as Mr. Robertson suggests, be the male.

ACANTHONOTUS OWENII.

(Vol. I. p. 232.)

We have no hesitation in referring this species to the *Gammarus corniger* of Fabricius,* whose specific name has long priority over any of the other names quoted in the page above referred to, and must consequently be adopted instead of that employed by us. It is also identical with the *Epimeria tricristata* of Signor A. Costa (Mem. di Real. Accad. Sci. Napoli, i. tab. 2, f. 2, 1853).

ATYLUS GIBBOSUS.

(Vol. I. p. 248.)

Specimens of this species have been sent to us by Mr. Robertson, who took them on three different occasions in Kames Bay, imbedded in sponge on the valves of *Pecten oper-*

* Iter Norwag. d. 20 Aug.; Spec. Ins. i. p. 517 (1781); Mant. Ins. i. p. 334 (1787); Ent. Syst. ii. p. 517 (1793).

cularis. From the position of the animals, they appear to have remained in one place while the sponge grew round them, and in some instances almost enclosed them. Mr. Robertson remarks, "It may be a nice point to settle whether the sponge serves for shelter or for food."

AMPHITHOË RUBRICATA.

(Vol. I. p. 418.)

This and all the species described in the pages from 418 to 493 belong to the section Domicola: the left-hand heading, "Amphipoda Natatoria," at the commencement of each genus and species, consequently requires correction.

COROPHIUM LONGICORNE.

(Vol. I. p. 494.)

With reference to the passage quoted by us from M. Quatrefages, Mr. Robertson writes to us: "In February last I had an opportunity of seeing *C. longicorne* at Dunbar, both at the mouth of the Clyde and in the bays, where there was no admixture of fresh water, at high water, having little doubt but that it is to be found on our shores all the year round. I have again seen it burrowing, which it does rather sluggishly. In this operation it brings the points of the long antennæ together, and pushes them into the mud; the fore-feet assist in widening the hole, and in turning the mud sideways; the hind-feet throw it backwards; the tail is carried at an angle downwards, which it presses against the mud, and forces itself forwards. My experience leads me to think that they do not burrow very deeply. I find them plentifully in the soft surface mud, but when I remove that away to the depth of about three inches, I have not found them in the firmer sub-soil."

Mr. Robertson has also kept them with Annelids in the same vessel until they died, without perceiving them attempting to touch the worms.

According to the rules of nomenclature recently laid down by the British Association for the Promotion of Science, the names of the sub-families adopted in this work should uniformly terminate in *ina* instead of *ides*.

The Annals of Natural History for December, 1868 (Ser. 4, vol. ii., p. 411—, and plates 21, 22, and 23), contain a Memoir by the Rev. A. F. Norman, in which the following species of Sessile-eyed Crustacea are described and figured :—

1. Haploops tubicola Lilljeb. (See our Vol. ii. p. 506.)
2. Tessarops (nov. gen. Norm.) hastata Norm. (? Tiron acanthurus Lilljeb. ? Syrrhoe bicuspis Goes.) Aberdeen coast.
3. Nicippe tumida Bruzel. (See our Vol. ii. p. 511.)
4. Eriopis elongata Bruzel. Sound of Skye.
5. Moera Loveni Bruzel. Sound of Skye.
6. Moera Batei Norm. (See our Vol. ii. p. 515.)
7. Helleria (nov. gen. Norm.) coalita Norm. Shetland, Moray Firth, and Firth of Clyde.
8. Microprotopus (nov. gen. Norm.) maculatus Norm. Tobermory, Isle of Mull.
9. Cirolana truncata, n. sp. Norm. St. Magnus Bay, Shetland.
10. Anilocra Mediterranea Leach, Desm. In rock pools at Herm.

ALPHABETICAL INDEX.

The sectional and family names are printed in capitals.

The specific names are arranged alphabetically under each generic name.

The synonymical names of the genera are enclosed in brackets.

| | Page | | Page |
|--------------------------|------------------|-------------------|------------------|
| ABERRANTIA (Amphipoda) . | ii. 28 | (Anisocheirus) . | ii. 119 |
| ABERRANTIA (Isopoda) . | ii. 116 | (Anisopus) . | i. 416 |
| Acanthonotus . | i. 231 | Anonyx . | i. 91 |
| Owenii . | i. 232 & ii. 528 | ampulla . | i. 116 |
| Æga . | ii. 276 | denticulatus . | i. 101 |
| bicarinata . | ii. 278 | Edwardsi . | i. 95 |
| monophthalma . | ii. 286 | Holbolli . | i. 104 |
| peora . | ii. 283 | longicornis . | i. 91 & ii. 510 |
| tridens . | ii. 281 | longipes . | i. 113 |
| ÆGIDÆ . | ii. 275 | minutus . | i. 108 |
| Ægina . | ii. 49 | obesus . | i. 98 |
| ÆRO-SPIRANTIA . | ii. 438 | Plantus . | i. 111 |
| Allorchestes . | i. 38 | Anthura . | ii. 157 |
| imbricatus . | i. 43 | gracilis . | ii. 190 |
| Nilssonii . | i. 40 & ii. 527 | ANTHURIDÆ . | ii. 155 |
| (Amathia) . | i. 359 | Aora . | i. 279 |
| Amathilla . | i. 359 | gracilis . | i. 281 |
| Sabini . | i. 361 | Apseudes . | ii. 144 |
| Ampelisca . | i. 125 | Latreillii . | ii. 153 |
| Belliana . | i. 135 | Talpa . | ii. 148 |
| Gaimardii . | i. 127 | AQUASPIRANTIA . | ii. 209 |
| lævigata . | ii. 504 | (Araneops) . | i. 125 |
| AMPELISCIDES . | i. 124 | ARCTURIDÆ . | ii. 359 |
| Amphilochus . | i. 179 | Arcturus . | ii. 361 |
| manudens . | i. 180 | gracilis . | ii. 373 |
| AMPHIPODA . | i. 1 | intermedius . | ii. 371 |
| (Amphithoë) . | i. 252 | longicornis . | ii. 365 |
| Amphithoë . | i. 416 | (Armadillidium) . | ii. 492 |
| albomaculata . | i. 426 | Armadillo . | ii. 492 |
| Gammaroides . | i. 427 | vulgaris . | ii. 493 |
| littorina . | i. 422 | ASELLIDÆ . | ii. 813 |
| rubricata . | i. 418 | Asellus . | ii. 841 |
| ANCEIDÆ . | ii. 168 | aquaticus . | ii. 848 |
| Anceus . | ii. 170 | Atylus . | i. 244 |
| Edwardii (Praniza) . | ii. 201 | bispinosus . | i. 250 |
| fuscata (Praniza) . | ii. 197 | gibbosus . | i. 248 & ii. 528 |
| Halidaii . | ii. 203 | Swammerdamii . | i. 246 |
| maculata (Praniza) . | ii. 199 | Bathyporeia . | i. 302 |
| maxillaris . | ii. 187 | pelagica . | i. 309 |

| | Page | | Page |
|--------------------------|------------------|------------------------------|---------|
| Bathyporeia pilosa . . . | i. 304 | Crangonyx subterraneus . . . | i. 327 |
| Robertsoni . . . | i. 307 | Cratippus . . . | i. 484 |
| (Bellia) . . . | i. 187 | tenuipes . . . | i. 485 |
| BOPYRIDÆ . . . | ii. 210 | (Cratophium) . . . | i. 484 |
| Bopyrus . . . | ii. 214 | (Crossurus) . . . | ii. 119 |
| Squillarum . . . | ii. 218 | (Cryptoniscus) . . . | ii. 257 |
| Calliope . . . | i. 258 | Cryptothiria . . . | ii. 257 |
| Fingalli . . . | i. 263 | balani . . . | ii. 267 |
| grandoculis . . . | i. 265 | pygmaea . . . | ii. 261 |
| laeviuscula . . . | i. 259 | CYAMIDÆ . . . | ii. 77 |
| Ossiani . . . | i. 261 | Cyamus . . . | ii. 80 |
| Callisoma . . . | i. 119 | Ceti . . . | ii. 85 |
| orenata . . . | i. 120 | gracilis . . . | ii. 94 |
| Campecopea . . . | ii. 433 | ovalis . . . | ii. 91 |
| Cranchii . . . | ii. 436 | Thompsoni . . . | ii. 96 |
| hirsuta . . . | ii. 434 | (Cymadusa) . . . | i. 416 |
| Caprella . . . | ii. 49 | Cymodocea . . . | ii. 425 |
| acanthifera . . . | ii. 65 | emarginata . . . | ii. 428 |
| acutifrons . . . | ii. 60 | truncata . . . | ii. 426 |
| sequilibra . . . | ii. 71 | Cyrtophium . . . | i. 479 |
| hystrix . . . | ii. 63 | Darwinii . . . | i. 481 |
| linearis . . . | ii. 52 | Danaia . . . | i. 67 |
| lobata . . . | ii. 57 | dubia . . . | i. 68 |
| spinulata . . . | ii. 74 | Darwinia . . . | i. 182 |
| tuberculata . . . | ii. 68 | compressa . . . | i. 184 |
| typica . . . | ii. 75 | Darcothoë . . . | i. 459 |
| CAPRELLIDÆ . . . | ii. 85 | punctatus . . . | i. 461 |
| (Ceradocus) . . . | i. 335 | Dexamene . . . | i. 236 |
| (Cerapodina) . . . | i. 452 | spinosa . . . | i. 237 |
| Cerapus . . . | i. 452 | tenuicornis . . . | i. 240 |
| abditus . . . | i. 455 | Vedlomensis . . . | i. 242 |
| difformis . . . | i. 457 | DOMICOLA . . . | i. 414 |
| Cheirocratus . . . | ii. 513 | Dryope . . . | i. 487 |
| mantis . . . | ii. 513 | crenatipalmata . . . | i. 490 |
| Chelura . . . | i. 205 | irrorata . . . | i. 488 |
| terebans . . . | i. 503 | Dulichia . . . | ii. 80 |
| CHELURIDÆ . . . | i. 501 | falcata . . . | ii. 83 |
| Cirolana . . . | ii. 294 | porrecta . . . | ii. 31 |
| Cranchii . . . | ii. 296 | DULICHIDÆ . . . | ii. 28 |
| spinipes . . . | ii. 299 | Dynamene . . . | ii. 417 |
| Conilera . . . | ii. 302 | Montagui . . . | ii. 423 |
| cylandracea . . . | ii. 304 | rubra . . . | ii. 419 |
| COROPHIDÆ . . . | i. 414 | viridis . . . | ii. 421 |
| COROPHIDES . . . | i. 478 | (Dyopedos) . . . | ii. 80 |
| Corophium . . . | i. 492 | Riscladus . . . | i. 411 |
| Bonellii . . . | i. 497 | longicaudatus . . . | i. 412 |
| crassicorne . . . | i. 499 | (Elasmopus) . . . | i. 434 |
| longicorne . . . | i. 493 & ii. 529 | Rentoniscus . . . | ii. 265 |
| Crangonyx . . . | i. 326 | Porcellanæ . . . | ii. 265 |

INDEX.

538

| | Page | | Page |
|------------------------|---------|-------------------------|------------------|
| (Erichthonius) . . . | i. 452 | Idotea emarginata . . . | ii. 386 |
| (Eupheus) . . . | ii. 144 | linearis . . . | ii. 388 |
| Eurydice . . . | ii. 307 | parallela . . . | ii. 391 |
| pulchra . . . | ii. 310 | pelagica . . . | ii. 384 |
| Eurystheus . . . | i. 353 | tricuspidata . . . | ii. 379 |
| bispinimanus . . . | i. 357 | Idoteidæ . . . | ii. 375 |
| erythrophthalmus . . . | i. 354 | Ione . . . | ii. 251 |
| Eusirus . . . | i. 266 | thoracica . . . | ii. 255 |
| Helvetiæ . . . | i. 267 | (Iphimedia) . . . | i. 244 |
| (Galanthis) . . . | i. 45 | Iphimedia . . . | i. 217 |
| Gammarella . . . | i. 329 | Eblanæ . . . | i. 221 |
| brevicaudata . . . | i. 330 | obesa . . . | i. 219 |
| Normanni . . . | i. 333 | Isæa . . . | i. 214 |
| GAMMARIDÆ . . . | i. 51 | Montagui . . . | i. 215 |
| GAMMARIDES . . . | i. 285 | (Ischyrocercus) . . . | i. 484 |
| GAMMARINA . . . | i. 11 | ISOPODA . . . | ii. 99 |
| Gammarus . . . | i. 366 | (Itea) . . . | ii. 454 |
| campylops . . . | i. 375 | Jæra . . . | ii. 314 |
| dubius . . . | i. 397 | albifrons . . . | ii. 317 |
| Edwardsii . . . | i. 386 | Nordmanni . . . | ii. 320 |
| locusta . . . | i. 378 | (Jæridina) . . . | ii. 320 |
| maculatus . . . | i. 399 | Janira . . . | ii. 335 |
| marinus . . . | i. 370 | maculosa . . . | ii. 338 |
| nolens . . . | ii. 19 | (Jassa) . . . | i. 484 |
| pulex . . . | i. 388 | Kroyera . . . | i. 171 |
| tenuimanus . . . | i. 384 | altamarina . . . | i. 177 |
| (Gnathia) . . . | ii. 170 | arenaria . . . | i. 173 & ii. 528 |
| Gossea . . . | i. 276 | brevicarpa . . . | ii. 508 |
| microdeutopa . . . | i. 277 | LAMODIPODA . . . | ii. 28 |
| Grayia . . . | i. 151 | (Læmatophylus) . . . | i. 479 |
| imbricata . . . | i. 152 | (Lalaria) . . . | i. 279 |
| Gyge . . . | ii. 223 | (Larunda) . . . | ii. 80 |
| Galathea . . . | ii. 225 | (Lembos) . . . | i. 287 |
| Hippolytes . . . | ii. 230 | Lepidepecreum . . . | ii. 509 |
| Haploops . . . | ii. 506 | carinatum . . . | ii. 509 |
| tubicola . . . | ii. 506 | Leptaspidia . . . | ii. 331 |
| (Hemioniscus) . . . | ii. 257 | brevipes . . . | ii. 333 |
| (Hiella) . . . | ii. 10 | (Leptocheirus) . . . | i. 297 |
| Hyperia . . . | ii. 10 | Leptochelia . . . | ii. 132 |
| cyanæa . . . | ii. 521 | Edwardsii . . . | ii. 134 |
| Galba . . . | ii. 12 | (Leptomera) . . . | ii. 36 |
| oblivia . . . | ii. 16 | (Leptothoë) . . . | i. 348 |
| prehensilis . . . | ii. 520 | Lestrigonus . . . | ii. 8 |
| tauriformis . . . | ii. 519 | exulans . . . | ii. 5 |
| HYPERIIDÆ . . . | ii. 2 | Kinahani . . . | ii. 8 |
| HYPERINA . . . | ii. 1 | Leucothoe . . . | i. 269 |
| Idotea . . . | ii. 376 | articulosa . . . | i. 271 |
| acuminata . . . | ii. 394 | furina . . . | i. 274 |
| appendiculata . . . | ii. 396 | (Leucothoë) . . . | i. 53 |

| | Page | | Page |
|----------------------------------|-------------------|-------------------------------------|------------------|
| LIBERATICA | ii. 313 | Montagua marina | i. 58 |
| Ligia | ii. 442 | monoculoides | i. 54 |
| oceanica | ii. 444 | norvegica | ii. 500 |
| Liljeborgia | i. 202 | pollexiana | i. 64 |
| pallida | i. 203 | Munna | ii. 323 |
| Shetlandica | i. 206 | Kroyeri | ii. 326 |
| Limnoria | ii. 349 | Whiteana | ii. 329 |
| lignorum | ii. 351 | Næsa | ii. 430 |
| (Liriope) | ii. 257 | bidentata | ii. 431 |
| (Liriopsis) | ii. 257 | NATATORIA | i. 50 |
| (Lonchomerus) | i. 279 | (Naupredia) | ii. 36 |
| (Lycesta) | i. 269 | Nicea | i. 45 |
| Lysianassa | i. 72 | Lubbockiana | i. 47 |
| Atlantica | i. 82 | Nicippe | ii. 511 |
| Audouiniana | i. 79 | tumida | ii. 511 |
| Costæ | i. 74 | Niphargus | i. 311 |
| longicornis | i. 86 | aquilex | i. 315 |
| LYSIANASSIDES | i. 71 | fontanus | i. 931 |
| Megamœra | i. 400 | Kochianus | i. 323 |
| Alderi | i. 407 | Nœnia | i. 471 |
| brevicaudata | i. 409 | excavata | i. 476 |
| longimana | i. 403 | rimapalmata | i. 474 |
| multidentata | ii. 515 | tuberculosa | i. 472 |
| Othonis | i. 405 | undata | i. 477 |
| semiserrata | i. 401 | NORMALIA (Amphipoda) | i. 11 |
| Melita | i. 335 | NORMALIA (Isopoda) | ii. 208 |
| gladiosa | i. 346 | (Nototropis) | i. 244 |
| obtusata | i. 341 | Œdiceros | i. 160 |
| palmata | i. 337 | parvi manus | i. 161 & ii. 523 |
| proxima | i. 344 | (Oliaka ?) | ii. 163 |
| (Microcheles) | i. 217 | ONISCIDÆ | ii. 439 |
| (Microdeutopus) | i. 287 | (Oniscoda) | ii. 335 |
| Microdeutopus | i. 287 | Oniscus | ii. 466 |
| anomalus | i. 293 | asellus | ii. 468 |
| fasciculatus | i. 295 | fossor | ii. 472 |
| gryllotalpa | i. 289 | Opis | ii. 501 |
| versiculatus | i. 295 | leptochela | ii. 501 |
| Websterii | i. 291 | quadrimana | ii. 503 |
| (Mœra) | i. 335 | Orchestia | i. 24 |
| Mœra | i. 348 | brevidigitata | ii. 497 |
| grossimana | i. 350 | Deshayesii | i. 36 |
| (Metoechus) | ii. 10 | littorea | i. 27 |
| Monoculodes | i. 163 | Mediterranea | i. 31 |
| carinatus | i. 165 | ORCHESTIDÆ | i. 12 |
| longimanus | ii. 507 & ii. 527 | Otus | i. 223 |
| Stimpsoni | i. 168 | carinatus | i. 224 |
| Montagua | i. 53 | (Panope) | ii. 80 |
| Alderi | i. 61 | Paranthura | ii. 163 |
| clypeata | ii. 499 | Costana | ii. 165 |

